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Future Strategies for Containerization in China

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FUTURE STRATEGIES FOR CONTAINERIZATION IN CHINA

by

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ABSTRACT

Since 1949, the ocean shipping fleet, port facilities, roadways, railways and inland waterway transportation system of the People's Republic of China have all been developed rapidly. Today, the transportation industry plays one of the most important roles in China's national economic development.

Following the worldwide development of containerization, China has established a highly visible container transport system in terms of its containership fleet and container berths during the 1980s. As a result, it has been recognized widely that China has entered into its second phase of development in containerization. However, China's future development in containerization faces a new challenge. It is noteworthy that there are some apparent weaknesses in this newly established system. First of all, China's transportation development, as well as its national economy as a whole, has long been directed by political decisions. Future success in containerization will be strongly influenced by decision-making on how to allocate the country's limited available financial resources, and the future trends of trade activities.

Also, China's inland transportation systems are so weak that they do not match current shipping and port capacities. Therefore, the second phase of development in

containerization can not be solely predicted by its first phase achievement. China's further development in containerization would depend highly on whether or not China can overcome its weaknesses in inland transportation systems.

In this paper, China's national container transport management network will be first introduced. Next, the past achievements and current status of all types transportation systems which are associated with container movements will be evaluated. Then, existing barriers to an efficient container transport system will be discussed. Finally, recommendations on China's future containerization planning will be presented based on an analysis of China's political and economic situation and the worldwide container service projections.

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INTRODUCTION

General Introduction

Ocean shipping has been going on for thousands of years, but was revolutionized in 1956 when Malcom P. McLean introduced the container into shipping service. Since then containerships have evolved rapidly, from their original first generation to their current fourth generation. In terms of capacity, for example, the first generation containership only had a capacity of about 200 TEUs, while the current fourth generation vessel has a capacity of over 4,000 TEUs (see Table 1). The total capacity of the world container shipping fleet has also expanded dramatically, from 0.27 million TEUs in 1970 to the current 3.03 million TEUs (see Table 2). During the same period of time, port capacity as well as all inland transportation systems have grown in order to accommodate the container revolution in the shipping industry. Dr. Bruce E. Marti describes the current container transport system status as "...the container, a metal or plastic reusable box, has become ubiquitous in most trades involving industrialized developed economies and has apparently entered into a mature phase

Table 1 The Evolution Containerships

	Time	Length (ft.)	Beam (ft.)	Draft (ft.)	Speed (knots)	TEUs
1st Generation:						
*Converted dry cargo vessel	1950s	450	76	<30	16	< 700
*Converted oil tanker	1960s	630	90	30	16	< 700
2nd Generation:						
*Cellular containership	1970s	700	90	33	23	700-1500
3rd Generation:						
*Panamax class	1980s	860-965	105	38-41	23	1500-3000
4th Generation:						
*UltraPanamax	1988-95	900-1000	135	38-42	23	> 3000

Source: Summarized from Oceanus 32(3): 45, Fall 1989.

Table 2 The Worldwide Growth of Container Fleet (1970-1989)

	Number of Ships[1]	TEU Capacity	Thousands of grt[2]	Index by TEUs
1970	258	93,896	1,908	100
1971	361	134,083	2,781	143
1972	312	182,322	4,310	194
1973	394	295,491	5,899	315
1974	412	332,222	6,295	354
1975	419	366,601	6,244	390
1976	443	411,531	6,685	438
1977	507	470,581	7,543	501
1978	531	504,839	8,674	538
1979	594	613,500	9,996	653
1980	662	500,959	11,274	534
1981	707	554,218	12,292	590
1982	718	598,120	12,942	637
1983	786	697,459	14,194	743
1984	940	832,112	16,912[3]	886
1985	1,011	942,222	18,364	1,003
1986	1,064	1,087,775	19,609	1,158
1987	1,093	1,215,215	21,089	1,294
1988	1,115	1,292,333	22,109	1,376
1989	1,122	1,408,480	22,735	1,500

Note: [1] the total number of fully cellular containerships.
[2] gross registered tons.
[3] data of container ships and lighter carriers have been combined by Lloyd's Shipping Information Services since 1984.

Source: Summarized from Lloyd's Register of Shipping -- Statistical Table, 1970 through 1989. London, U.K.; and Review of Maritime Transport, 1970 through 1989. United Nations Conference on Trade and Development. New York, United Nations.

causing concern to both port authorities and ocean carriers". In fact, it has been observed that container transport in shipping has been increased much more rapidly than seaborne traffic in general during the last two decades. Both the appearance and substance of all related transportation systems have been changed by containerization.

Although containerization was initiated and first developed by western industrialized countries, it has also received a fair amount of attention and participation from developing countries, particularly from Far East countries and regions. The growth rate for container port traffic in developing countries has been almost twice that of the world rate, reaching 14.8 percent in the period of 1986-1987. Currently, nine of the world's top 20 carriers are Asian operators, which accounts for almost half of all the slots in service (see Table 3). And in terms of container throughput, eight of the world's top 20 ports are located in the Far East region (see Table 4). However, containerized transport systems are highly concentrated innovations that require enormous capital investments, advanced technologies and managerial skills. It is hard for a large developing country, such as China, to establish an effective container transport network in a short period of time, because of geographical conditions and the unevenly-developed economy. On the contrary, for small countries or regions, such as

Table 3 1990 World's Top 20 Container Service Operators Analyzed on the Basis of Vessel Type (TEU Capacity)

Operator	FC/CC[1]	RC[2]	RR[3]	BC[4]	SC[5]	Total
Evergreen	130916	0	0	0	0	130916
Sea-Land	111538	3829	0	0	0	115367
Maersk	85898	6500	0	0	2305	94703
NYK	69190	0	250	0	8708	78148
MOL	54438	0	750	782	14364	70334
APL	66125	0	255	0	0	66380
OOCL	58117	0	0	0	0	58117
K-Line	52383	0	0	848	2231	55462
COSCO Shanghai	44193	2259	2466	3420	2167	54505
Hapag-Lloyd	49368	0	0	0	3810	53178
Hanjin	49621	0	0	0	0	49621
P&O Containers	46772	0	0	1328	1268	49368
Yangming	46817	0	0	0	0	46817
Zim	39739	0	0	0	5177	44916
Nedlloyd	21004	641	5460	989	12241	40335
BSC	14196	0	18371	0	4193	36760
NOL	34013	1281	0	0	0	35294
ScanDutch	31040	401	0	0	1507	32948
SNCDV	13937	2312	3836	574	10545	31204
CGM	16842	6758	3368	1176	896	29040
Total	1036147	22981	34756	9117	69412	1173413
World Total	1646732	105491	267579	316826	689552	3026180
Top 20 Share	62.9%	21.8%	13.0%	2.9%	10.1%	38.8%

Note: [1] fully cellular/converted to fully cellular ships.
[2] Cellular ships with roll on/roll off capacity.
[3] roll on/roll off ships.
[4] barge carriers.
[5] semi-containerships.

Source: Containerization International 24(6): 47. June 1990.

Table 4 1989 World's Top 20 Container Ports
(TEU Throughput)

Position				TEU Throughput		
1989	1988	1987	Port	1989	1988	1987
1	1	1	Hong Kong	4,463,709	4,033,427	3,457,182
2	2	4	Singapore	4,364,400	3,375,100	2,634,500
3	3	2	Rotterdam	3,603,161	3,288,829	2,813,395
4	4	3	Kaohsiung	3,382,512	3,082,838	2,778,786
5	5	6	Kobe	2,458,964	2,263,214	1,996,626
6	7	7	Busan[1]	2,158,828	2,065,462	1,949,143
7	9	9	Los Angeles	2,056,629	1,652,069	1,579,629
8	6	5	New York	1,988,318	2,095,530	2,089,421
9	8	8	Keelung	1,787,067	1,709,763	1,939,854
10	10	11	Hamburg	1,727,609	1,621,615	1,451,351
11	11	10	Long Beach	1,545,243	1,484,467	1,460,287
12	13	13	Yokohama	1,506,338	1,452,857	1,345,383
13	12	12	Antwerp	1,473,746	1,469,949	1,437,193
14	14	14	Tokyo	1,438,521	1,396,026	1,287,974
15	15	16	Felixstowe	1,370,271	1,278,893	1,053,000
16	16	15	San Juan	1,289,001	1,245,311	1,169,808
17	17	17	Bremen	1,203,955	1,121,454	1,043,213
18	18	19	Oakland	1,090,597	1,031,776	953,861
19	19	18	Seattle	1,040,890	1,024,035	1,026,398
20	22	20	Tacoma	924,974	781,816	696,800

Note: [1] excluding transshipment

Source: Summarized and Calculated from Containerization International Yearbook, 1988 through 1990. London. U.K.

Singapore, South Korea, Taiwan, and Hong Kong, developing such a network is relatively easy. The ability of a country to establish an effective container transport network depends not only on its political and economic structure, but also on the present transportation conditions, the available financial and material resources, and the geographic setting.

Statement of Purpose

Following ten years of rapid growth, which was reflected by an expanded container fleet and newly built container berths, China has entered into its second phase in containerization development. In its second phase, the principal tasks should be focused on the establishment of a comprehensive container transportation network. However, there are still some uncertainties. What are the costs and benefits of the second stage development? Is China well prepared to provide financial resources and managerial skills? Which link in the network should be considered the highest priority in the second phase development? The purpose of this study is to attempt to answer these questions.

This paper focuses on China's containerization development. First, the national transportation management system will be introduced. Secondly, the past achievements and present situation of all transportation systems, with an

emphasis on shipping and ports, will be described. Then, the existing barriers to an efficient container transport system will be discussed. Finally, recommendations on China's future containerization planning will be presented based on an analysis of China's political and economic situation, and worldwide container service projections.

Hypothesis

It is hypothesized in this study that there is a great potential demand for container services in China. The current container transport network can not meet such a large demand. But, further progress in increasing container services will strongly depend on China's political situation. Even under favorable political circumstances, however, progress will not be as significant as that gained in the first stage development. Future success in having a comprehensive container transport network will require a further decentralized management system. Rational use of the rather limited financial resources will play a critical role in the future. Priorities must be set among the different types of transportation systems associated with container movements.

Methodology

In general, studies of transportation have followed two approaches. One is a broad approach which analyzes the

structure and linkage of an existing transport network. The other is more narrow, focussing on a particular region, tracing and identifying the processes that affected the development of transportation within that region. Different as they are, concerns of the relationship between transportation and national economic and political development are the dominant issues in either approach.

Since the purpose of this study is to focus on China's future containerization plan, the national management system must be first introduced. All the transport systems that involve container movements will be examined. These are: the shipping fleet, port facilities, roadways, railways and inland waterways. Previous development, present conditions, and existing problems will be described and analyzed within each system. The interrelationships among different systems will also be addressed. A priority ranking of each system will be provided based on above mentioned studies. China's current political and economic situation, and the worldwide related issue projections, as a recommendation for rational use of limited available financial and material resources will be provided.

CHAPTER II

NATIONAL CONTAINER TRANSPORT MANAGEMENT SYSTEM

Geopolitical Characteristics of China

China, officially known as the People's Republic of China, is situated in the eastern part of the Asian Continent and along the western boundary of the Pacific Ocean (see Figure 1). It is characterized both as a continental and maritime nation. China's territory of 9.6 million square kilometers (3,691,500 square miles) measures 5,200 kilometers (km) east to west and 5,500 km north to south. It shares a land border with North Korea in the northeast; the Soviet Union in the northeast and northwest; Mongolia in the north; Afghanistan and Pakistan in the west; India, Nepal, and Bhutan in the south; Burma, Laos, and Vietnam in the southeast. Along its 18,000 km coastline, from the east to the southeast, China faces North Korea, South Korea, Japan, Philippines, Malaysia, and Indonesia.

China is geographically a diverse country. Its geographic conditions vary from region to region (see Figure 2). In general, the altitude declines from the west and northwest down to the east and southeast. Geographers usually divide the country into two parts by the Aihui-

Figure 1 The Geographical Position of China

Source: Atlas of the People's Republic of China. Atlas Publishing House. Beijing. China. 1985

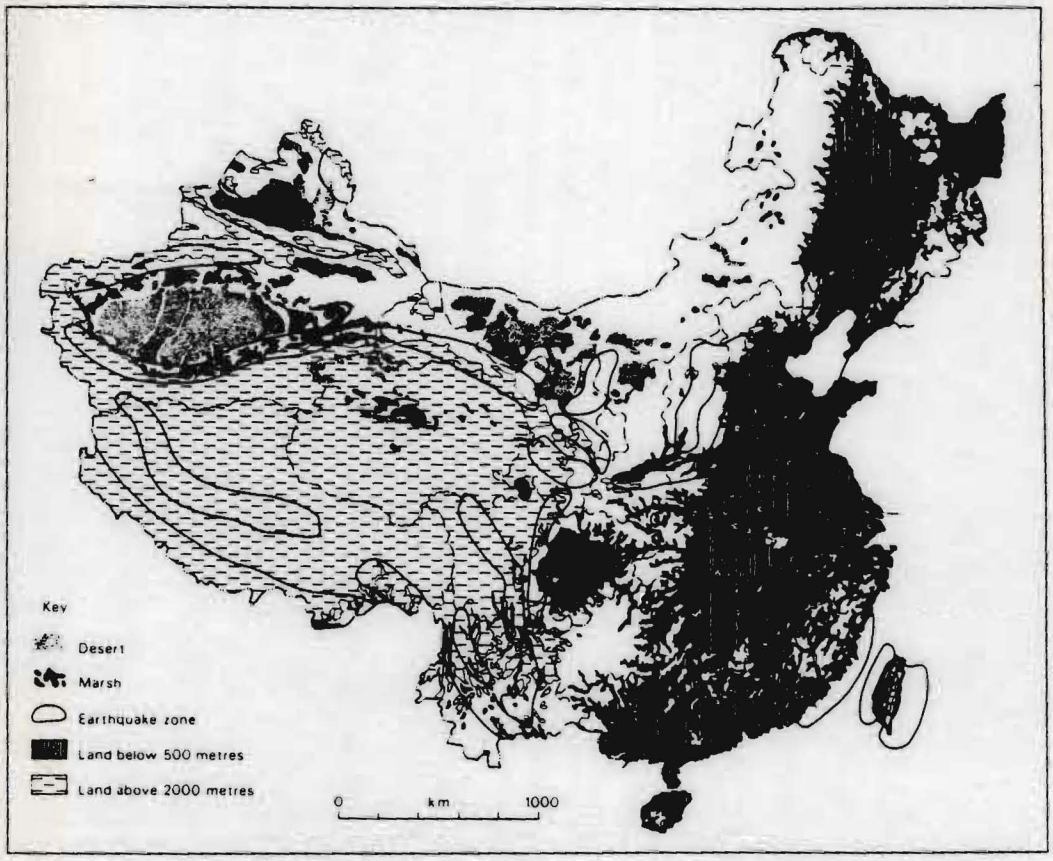

Figure 2 The Hostile Land of China

Source: "China's Topography". China Reconstructs. Beijing. China. September, 1971

Tengchong Line (see Figure 3). To the east of the line, is essentially a region of fertile river valleys and plains, lowlands and foothills, and a favorable climate. To the west of the line, is mostly a realm of inhospitable terrain, including the highest mountain chains and plateaus, the deepest basins, and the greatest deserts. The western part accounts for 60 percent of China's territory, but only six percent of its total population and five percent of its gross value of industrial and agricultural output. The vast size of the country and the barrenness of the western hinterland have caused China to be a nation oriented not toward the sea but inland during the ancient times. Only after 1949, this isolation ended as China increased links with the rest of the world.

The population of China has long been the world's largest, accounting for approximately 25 percent of the world total. With such a large population living on only five percent of the world's arable land, China is always on the cutting edge of the conflict between population growth and economic development.

China's economy shares a number of basic characteristics with those of developing countries. The country's gross national product (GNP) per capita is still at the lower end of the range for nations categorized by the World Bank as "middle income developing countries". China's economy is

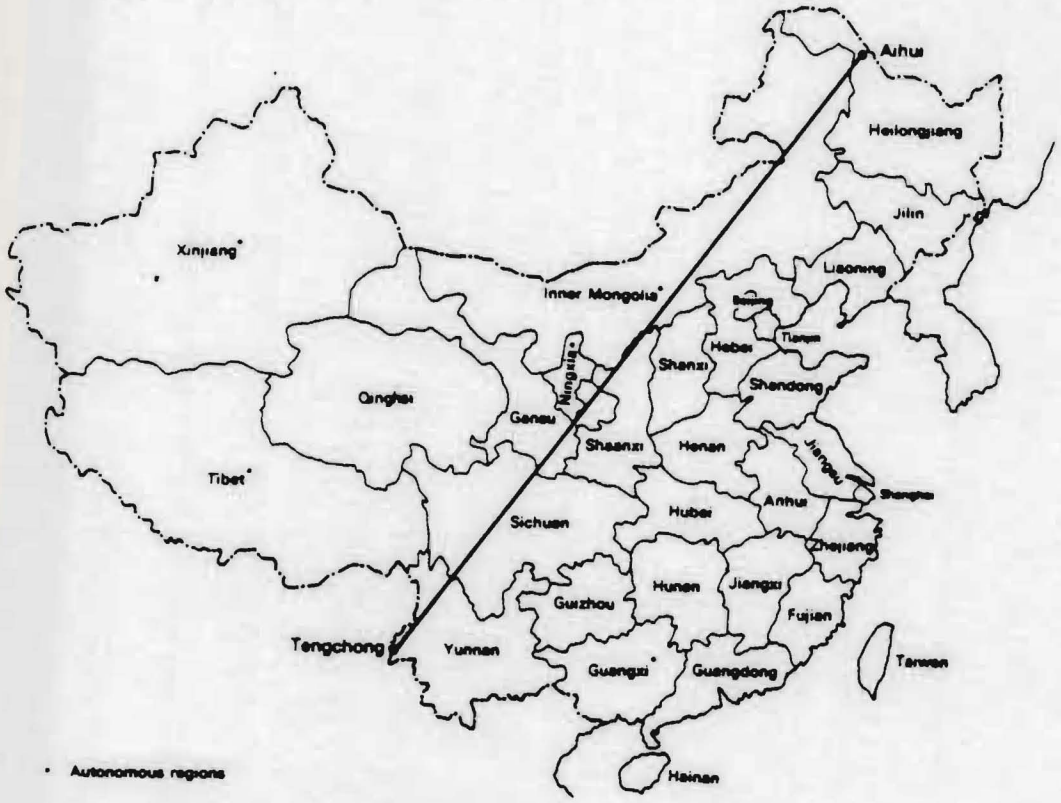

Figure 3 The Aihui-Tengchong Division of China

Source: Atlas of the People's Republic of China. Atlas Publishing House. Beijing. China. 1985

different from those of most developing countries in that it is organized as a socialist system and controlled by a centralized planning mechanism. Since 1949, China has been a unitary and socialist state led by the Chinese Communist Party (CCP). With a centrally planned socialist economy, planning and control are exercised over provincial and local governments from the central government. This is in contrast to the federal system in the United States. All banking systems, redistribution of resources among regions, and rationing of many important consumer goods are under tight central control. Most factories and enterprises are owned by the State and operated under the State planning and administration, although some of them are collectively owned. There is little private ownership in the means of production. In agriculture, however, nearly all property belongs to collective units in the rural commune system.

National Container Transport Management System

The importance of transportation in China's national economic construction was recognized gradually with the rapid increase of population, the economic recovery after World War II, and the increase in trading activity. Transportation has been regarded as the vanguard in the development of the national economy shortly after 1949. Generally speaking, the central government sets up annual production targets, and is responsible for providing funds

for all different types of transportation, including the national railway and roadway systems; and ocean, coastal and inland waterway shipping services.

Central government institutions involved in container transport administrations and operations include the Ministry of Communications (MoC); the Ministry of Railways (MoR); and the Ministry of Foreign Economic Relations and Trade (MoFERT). In addition, the State Council (SC), the State Planning Commission (SPC), the State Economic Commission (SEC), and only recently, provincial and municipal governments also participate in planning and financing the national container transport system to various degrees. Controlling powers and responsibilities, that overlap in the national transport management system, are frequently shifted among ministries, and between ministries and provincial governments. Therefore, it is necessary to illustrate, in a general way, the associated functions and responsibilities that each institution possesses.

The State Council

The present structure of the Chinese government was set up based on the State Constitution of 1982, which was adopted by the National People's Congress (NPC) in December 1982. According to the Constitution, the NPC is the highest legislative body in China. The State Council, which is equivalent to the Cabinet of many western countries or to

the Council of Ministers in the Soviet Union, is the executive body of the highest organ of state power, and is responsible for the NPC. It is chaired by the Premier, and composed of various commissions, ministries, and specialized agencies.

The functions and powers of the SC cover virtually every aspect of the administration of the country. In principle, it has powers to formulate administrative measures; to issue decisions and orders and monitor their implementation; to prepare for the national economic plan and the State budget; and to ensure unified leadership over the activities of various commissions, ministries, and agencies. Thus it can alter or annul inappropriate orders, decisions, and regulations issued by its subordinates. In practice, the SC relies on commissions, ministries, and specialized agencies to carry out its orders.

Another feature in China's administrative system is the embedded controlling power of the CCP. The CCP organizations actually parallel all administrative subdivisions. The positions of Premier, commission chairman, minister, and province-level governor are often held by key members of the CCP. The Party, of course, plays the main role in formulating and overseeing the execution of basic national policies.

The Provincial Governments

The administrative organ immediately below central level is the provincial government consisting of 22 provinces, three centrally governed municipalities, and five autonomous regions (see Figure 4). The functions and powers of the governments at this level are to execute the Constitution and laws, to implement the State policies and plans, and to examine and approve local economic plans and budgets.

In transportation-related fields, provincial governments have recently received a share of rights in roadway, railway, and port operations and construction with the competent ministries. At present, roadway transportation is mainly controlled by provincial governments with little interference of central government. Port operations have just been transferred to provincial or municipal governments from their former central ministry, the MoC. Most ports are now operated by provincial or municipal port authorities with central coordination by the MoC. This new development is to be considered a major step towards a decentralized national transport management. Railway and shipping operations, however, are mainly operated by the central ministries, namely, the MoR and the MoC, with a little involvement of local government.

Conceptually, provincial governments are still not responsible for national transportation planning, or collecting funds for any planned construction works. These

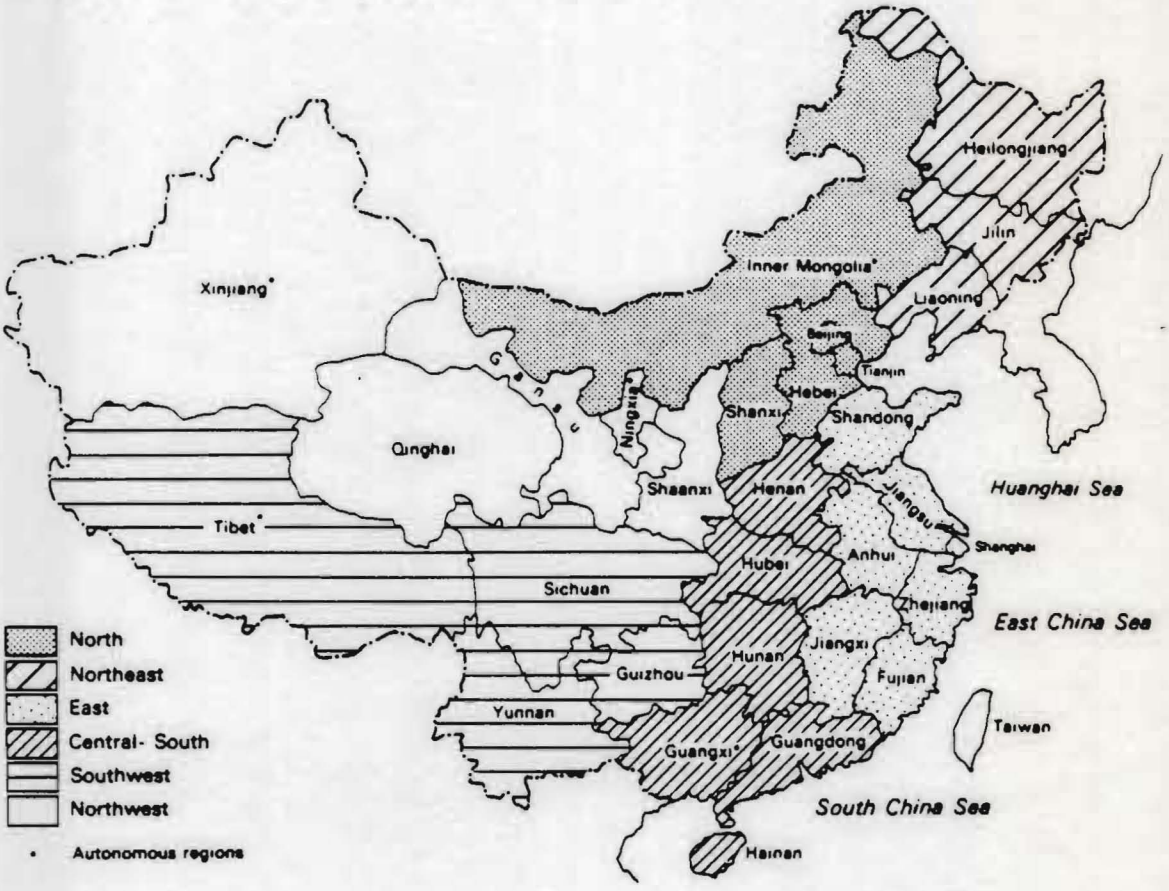

Figure 4 China's Administrative Regions and Provinces

Source: Atlas of the People's Republic of China. Atlas Publishing House. Beijing. China. 1985

are the responsibilities of the correspondent commissions and/or ministries.

The Ministry of Foreign Economic Relations and Trade

Directly subordinated to the State Council, the Ministry of Foreign Economic Relations and Trade was created in 1982 by merging the Ministry of Foreign Trade with the Foreign Investment Control Commission and the Import-Export Commission. The MoFERT is responsible for the country's trade system, including establishing import-export license systems, and imposing import-export duties. The MoFERT used to draw up specific and detailed import-export plans, carry out negotiations, and draft and sign contracts. However, since 1984, the MoFERT has been restructured to be mainly responsible for overall policy-making, without actual participation in foreign trade transactions. Most of its previously operated foreign trade corporations have become independent. At present, the country's trade is mainly conducted by a variety of specialized foreign trade corporations.

The MoFERT also has been deeply involved in shipping activities. It used to collect and distribute the country's entire international trade cargoes. As a subsidiary of the MoFERT, China National Foreign Trade Transportation Corporation (SINOTRANS) is the organizer of China's foreign trade transportation and the general freight forwarding

agent for most import and export corporations in China. It renders the services of transporting import and export cargoes by sea, air, post, railway, roadway, and inland waterway. It has a designated power to do ship chartering, purchasing or selling, and to act as shipping agents and even control the warehousing business. Although some local trading companies have entered the field of international freight forwarding recently, SINOTRANS is still the biggest, most powerful and comprehensive freight forwarder in China.

During the past 40 years, SINOTRANS has set up 56 branches, 350 sub-branches and 45 joint ventures in China, and established 20 subsidiaries and joint ventures and nine representative offices abroad. It has also built up agency relationship with companies in several hundred ports, and formed a global transportation network connecting China with the rest of the world.

Ocean shipping is the principal business of SINOTRANS. In 1988, SINOTRANS handled the space booking, receipt, delivery, customs clearance and transshipment of more than 100 million tons of import and export cargoes. It also pioneered cargo movements by containers in China. In 1973, it was SINOTRANS that initiated the Sino-Japan container liner service in cooperation with Japanese shipping companies, which played a decisive role in pushing China's container transportation forward.

SINOTRANS' chartering business is dealt with by China National Chartering Corporation (SINOCHART). SINOCHART handles the chartering, subleting, purchasing and selling of vessels and operates time chartered vessels. To maximally conserve scarce foreign currency, SINOTRANS assigns the country's international cargoes to the MoC's China Ocean Shipping Company (COSCO) vessels first. If these ships can not provide sufficient services, either due to lack of quality or quantity, SINOTRANS then asks COSCO's Hong Kong subsidiaries, which operate ships flying flags of convenience, to do the job. Only when both options are not available, does SINOTRANS charter ships from foreign carriers through SINOCHART. Despite all kinds of institutional changes in trade activities, this national policy has not changed. All foreign trade participators in China are still required to use China's shipping service first. All vessel chartering transactions are still strictly confined to SINOCHART.

The Ministry of Communications

Despite the existence of overlapping administrative responsibility, there is no doubt that most containerization activities are either directly or indirectly managed by the Ministry of Communications. Also directly subordinated to the SC, the MoC was established in October 1949. It is the executive organ of the SC in the transportation fields.

excluding railway and airway activities, which are under the administrative scope of the MoR and the Civil Aviation Administration of China (CAAC) respectively. The responsibility for shipbuilding was transferred to the China State Shipbuilding Corporation (CSSC) in May, 1982, when the central government was restructured.

The principal function of the MoC is to carry out state transportation planning associated with national roadway and waterborne shipping related activities. It is the responsibility of the MoC to prepare its own annual plan and budget which are subject to the SC's approval. The MoC is comprised of 21 bureaus and administrative departments with a staff of about 900. They coordinate the country's inland waterways, coastal and overseas shipping activities, port design and construction, harbor superintendency, dredging, navigation aids, rescue and salvage, and national roadway planning, designing, and constructing. Roadway operations and maintenances are mainly conducted by province-level transportation bureaus, and involve little coordination efforts with the MoC.

Several key bureaus that are heavily involved in container transport activities, such as the China Ocean Shipping Company, the Harbor Engineering Corporation, the Roadway Engineering Corporation, the Inland Waterway Administration, and the Container Transport Corporation, are briefly described in the following sections.

The China Ocean Shipping Company (COSCO)

In April 1961, the China Ocean Shipping Company was established as a state-owned commercial undertaking to meet China's overseas transportation needs. COSCO was the first and the only national-flag ocean shipping company at that time. It was designated the principal carrier of China's overseas trade. COSCO plays no part in domestic coastal and inland waterway services. The coastal shipping services are mainly directed by the MoC's Marine Transport Administration with an increasing participation of provincial owned local shipping companies.

In its administrative structure, COSCO has five key subsidiaries in Dalian, Tianjin, Qingdao, Shanghai and Guangzhou, respectively, with a total employment of about 50,000 seamen and office workers. Each subsidiary generally specializes on specific commodities. For example, COSCO Shanghai and Tianjin are more concentrated on container transport, and COSCO Dalian on petroleum and coal, etc. In its early years, COSCO's activities were directly directed by its Beijing headquarters. As the scope of its liner services widened and the managers of subsidiaries demonstrated their capability to operate their ships with good results, they were given much more leeway from headquarters' control and command. But the headquarters still retains ultimate authority regarding the number and type of ships that subsidiaries can acquire, the opening of

additional liner services or bulk carrier and tanker tramp activities.

In addition, COSCO has formed domestic joint-venture shipping companies with the provincial governments of Jiangsu, Zhejiang, Hebei, Anhui and Jiangxi. The capacities of these shipping companies are quite limited, and each company only controls several old conventional ships. However, they are very much favored by the provincial governments, because they can earn foreign currency directly. COSCO has established about ten overseas offices all over the world.

In the past 30 years, COSCO's business scope has been broadening steadily, extending its tramp services to Japan, Southeast Asia, the Persian Gulf, the Red Sea, Africa, the Mediterranean, Europe, South America, Oceania, etc. In liner services, COSCO operates 47 container and general cargo liner services worldwide, including 33 key liner routes, making 141 sailings per month. Vessels of COSCO fleet call at over 600 ports in more than 150 countries and regions all over the world (see Figure 5).

The Harbor Engineering Corporation

Directly subordinated to the MoC, the Harbor Engineering Corporation is responsible for the country's port design, construction and maintenance. In detail, its

中国远洋运输航线
Cargo Lines Operated by
the China Ocean Shipping Company

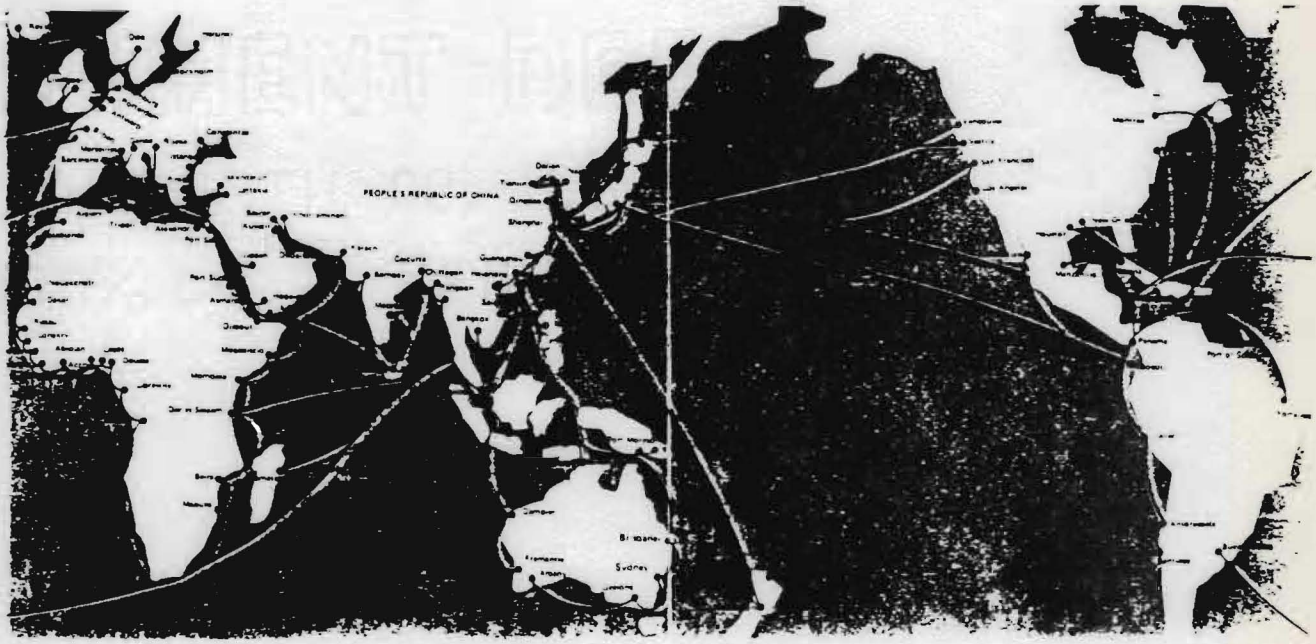

Figure 5 The COSCO's Overseas Shipping Routes

Source: China Ocean Shipping Company. A brochure published by the COSCO's Beijing headquaters in 1987

responsibilities include new port project design and construction, old port facility improvement, channel dredging, navigation aid project installation, and related scientific research. To some extent, this corporation acts pretty much like the Army Corps of Engineers does in the United States.

Besides its Beijing headquarters, there are four regional sub-corporations, located in Tianjin, Shanghai, Guangzhou and Wuhan. As the Beijing headquarters is mainly responsible for national port project coordination and scientific research, each sub-corporation is responsible for its regional projects. Along the coast, the Tianjin sub-corporation works mainly on the projects north of Port of Lianyungang; the Guangzhou sub-corporation takes care of projects south of Port of Xiamen; the Shanghai sub-corporation is in charge of projects between Lianyungang and Xiamen; and the Wuhan sub-corporation takes the responsibility of all river port projects along the Changjiang (the Yantze River).

In principle, the Harbor Engineering Corporation only involves itself in central government port projects, which are initiated by the MoC. They are not allowed to participate in any local port development. Although ports are mostly administered by provincial and municipal governments in China, container berths and large port projects need high capital investments and are involved in

high technology, and therefore need to be conducted by the Harbor Engineering Corporation. At present, the Harbor Engineering Corporation still has designated monopolistic power in most of China's port development activities.

The Roadway Engineering Corporation

Subordinated directly to the MoC, the Roadway Engineering Corporation is responsible for national roadway planning, designing and all related scientific studies. Differing from port development activities, roadways and the so-called expressways are mostly built by provincial and local labor forces. The Roadway Engineering Corporation only provides technological aid and limited superintendence in construction and maintenance to national trunk lines without any actual participation.

As most of the existing roadways in China were built with low standards, its current principal tasks are to improve the old roadway system to meet the requirements for container hauling, and designing the new national expressway system. However, it does not have a monopolistic power in China's roadway development activities.

The Inland Waterway Administration

As the direct subordinate administration body, the Inland Waterway Administration used to be in charge of the country's inland waterway transportation, including both

freight and passenger traffic planning and operation. As a result of decentralization, the function and power of this administration has been severely weakened. At present, all inland waterways are administered by provincial governments, except the Changjiang which is the largest inland waterway system. The Changjiang system is operated by the Changjiang Waterborne Transportation Authority, which is the major body of the Inland Waterway Administration.

The Container Transport Corporation

It was recognized by China's shipping planners in the late 1970s and the early 1980s that a containership had a greater efficiency than that of a break-bulk general cargo freighter. To move ahead with the development of containerized shipping, the MoC established the Container Transport Corporation in 1980. Under its coordination, COSCO has recently initiated joint transportation operation with more than 150 national enterprises engaging in foreign trade that are scattered over in more than 20 provinces and autonomous regions. The main task of this joint operation is to reinforce SINOTRANS' cargo collection and distribution network. However, the volume of cargo carried by this joint transportation operation is very low, and more importantly, the management is inefficient.

The purpose of establishing the Container Transport Corporation was to coordinate the country's domestic and

overseas container traffic. However, its efficiency seems quite low. The unevenly-developed transportation systems, which are administered under individual ministries, make the Container Transport Corporation even harder to fulfill its goals.

The Ministry of Railways

In China, the railways are directly owned by the central government and controlled by the Ministry of Railways. The MoR is fully responsible for the country's railway planning and designing, construction, maintenance, and operation. It also has monopolistic control in railway transport related manufactures, such as locomotives, rails tracks and carriages.

From 1949 to 1979, the MoR had undertaken great efforts to repair old tracks and construct new lines. China's total length of railway was increased from 21,800 km in 1949 to 49,800 km in 1979. Since 1979, the MoR has been concentrating on improving the efficiency of the old tracks, such as double-tracking and track-electrification. A detailed description of the railway development is presented in Chapter 3.

Within its administration system, there are about ten regional railway bureaus directly subordinated to the MoR who are responsible for the country's daily railway operations. Also directly subordinated to the MoR, there are

ten railway construction corporations in China who are responsible for railway maintenance, old line repairing, and new line designing and construction within each designated region.

CHAPTER III

CHINA'S TRANSPORTATION SYSTEMS AND THE DEVELOPMENT WITH CONTAINERIZATION

Development of transportation is an integral part of the progress of industry and commerce, and plays an indispensible role in the national economy. The level of development of transport facilities directly reflects the level of economic development of the country as a whole. It is widely believed that transportation systems in China have been developed significantly since 1949. However, the development has not kept pace closely with the increasing demand, which seriously impedes the current growth of national economy. The past successes and existing problems in transportation systems are presented in the following sections.

Ocean Shipping

The development of China's ocean shipping fleet dates back to the establishment of China Ocean Shipping Company in 1961. Since then, China has expanded its fleet and operations significantly in the wake of the rapid growth of China's international trade. In 1961, COSCO had a fleet of only 20 owned and five chartered vessels with a total

capacity of 229,900 deadweight tons (dwt) (see Table 5). It first acquired ships from the international secondhand market in the 1960s, and then from Chinese and foreign shipyards in the 1970s and 1980s. It can be seen from Table 5 that the greatest tonnage gains started in the 1970s, when China added about 700 ships of various types totaling 9.1 million dwt. It was from a very small base that China has developed into a worldwide competitor. At the present time, China owns and operates 1,534 vessels, including full container ships, multi-purpose and general cargo ships, roll on/roll off vessels, refrigerator ships, LASH, bulk carriers, oil tankers, timber carriers and passenger ships (see Table 6). Taking into account about 100 chartered vessels, the aggregate tonnage is more than 22 million dwt. And COSCO accounts for 75 percent of the country's total carrying capacity. Today, COSCO is the sixth largest freight shipping fleet in the world while its handling capacity places it at number eight. Based in the port cities of Dalian, Qinghuangdao, Tianjin, Qingdao, Shanghai, Guangzhou, and Zhanjiang, four major routes provide shipping services to ports all over the world. The Japan-North America-South America line is the most important line in China's foreign trade network. The line through Singapore to Indian Ocean and Atlantic Ocean ports is the busiest line, whose services cover Southern Asia, Africa, and Europe. The volume of the line to Southeast Asia and Oceania has increased steadily in

Table 5 The Capacity Growth of China's Merchant Fleet (1961-1990)[1]

Year	No. of Ships	grt	nrt	Total dwt (long ton)
1961	25	--	--	229,900
1965	63	--	--	601,800
1971	122	--	--	1,298,300
1974	317	1,842,462	--	--
1975	393	2,708,974	1,594,923	3,950,582
1976	460	3,474,013	2,062,025	5,194,866
1977	520	3,983,684	2,360,973	5,954,037
1978	601	4,978,256	2,946,837	7,519,554
1979	703	5,983,598	3,577,951	9,174,101
1980	754	6,344,154	3,778,969	9,659,893
1981	817	6,832,608	4,082,543	10,419,960
1982	886	7,435,586	4,421,170	11,338,637
1983	961	8,216,238	4,895,738	12,556,471
1984	1,020	8,827,859	5,188,535	13,354,986
1985	1,146	10,051,466	5,905,801	15,259,267
1986	1,315	11,468,500	6,504,200	17,409,900
1987	1,385	11,974,700	6,817,700	18,204,300
1988	1,412	12,358,700	7,030,400	18,803,900
1989	1,472	13,049,400	7,423,300	19,986,300
1990	1,534	13,509,700	--	20,579,400

Note: [1] as of October 1st of each year of vessels of 300 grt and over.

Source: Summarized from Shipping Statistics Yearbook. 1974 through 1990. Institute of Shipping Economics and Logistics. Bremen. Germany.

Table 6 China's Merchant Fleet by Ship Types (1985-1990)[1]

Ship Type	1985 No. of Ships	1985 1000 dwt	1985 1000 TEUs	1986 No. of Ships	1986 1000 dwt	1986 1000 TEUs
Oil Tankers	169	2205	-	152	2598	-
Bulk Carriers	154	5037	4.3	182	6094	4.3
Combined Carriers	1	17	-	1	17	-
General Cargo Ships	649	6094	18.0	752	6654	23.4
Containerships	13	196	9.8	32	529	26.8
Ferries	39	138	-	59	174	-
Passenger Ships	0	0	0	1	4	-
Total	1025	13687	32.1	1179	16070	54.6

Ship Type	1987 No. of Ships	1987 1000 dwt	1987 1000 TEUs	1988 No. of Ships	1988 1000 dwt	1988 1000 TEUs
Tankers	178	2719	-	189	2826	-
Bulk Carriers	207	6885	4.3	217	7184	4.3
Combined Carriers	1	17	-	0	0	0
General Cargo Ships	855	7219	28.8	882	7420	31.2
Containerships	38	633	31.8	46	782	39.0
Ferries	58	315	-	64	157	0.2
Passenger Ships	1	4	-	2	5	-
Total	1338	17629	64.9	1400	18372	74.8

Ship Type	1989 No. of Ships	1989 1000 dwt	1989 1000 TEUs	1990 No. of Ships	1990 1000 dwt	1990 1000 TEUs
Tankers	194	2683	-	201	2945	-
Bulk Carriers	221	7448	4.3	238	8025	4.3
Combined Carriers	0	0	0	0	0	0
General Cargo Ships	888	7513	36.5	925	7765	41.6
Containerships	48	828	41.7	56	1003	51.9
Ferries	59	143	0.2	61	144	0.1
Passenger Ships	2	5	-	2	5	-
Total	1412	18619	82.6	1483	19885	97.9

Note: [1] as of January 1st of each year.

Source: Summarized from Shipping Statistics Yearbook, 1986 through 1990. Institute of Shipping Economics and Logistics. Bremen, Germany.

recent years. The last line linking China with South Korea and the east coast of the Soviet Union has become more active after trade activities increased dramatically.

Prior to 1978, China did not pay much attention to container transport, mainly because of its inadequate port facilities, low volume of containerized trade, and more importantly, the high capital investment required. After trade with Japan, the U.S. and countries of European Economic Community (EEC) increased in late 1970s, China's shipping planners began to realize the high efficiency of container transport and started to develop containerization. This beginning was aided since most cargoes from these industrialized countries are shipped in containerized form. Another feature since 1978 is that China has begun to accept foreign investment and loans.

Since the first container liner service inaugurated between Shanghai and Australia in 1979, COSCO has rapidly expanded its shipping fleet (see Table 7). COSCO's 128 containerships range from small local feeders up to five 2,700-TEU capacity vessels. The total slot capacity of full and semi-container vessels has grown from 11,400 TEUs in 1981 to nearly 83,000 TEUs in 1989, and it will continue grow to over 96,042 TEUs by 1990. COSCO operates over 20 container scheduled liner services with about 60 sailings per month (see Table 8). Its box inventory has also increased rapidly during the decade. Today, COSCO operates

Table 7 The Capacity Growth of the COSCO Container Fleet (1981-1989)

Year	Number of Vessels			Capacity in TEUs	
	Semi Container Ships	Roll on/ Roll off Ships	Fully Cellular Ships	Fully Cellular	Total Slot
1981	18	14	0	0	11,400
1982	18	14	1	200	11,593
1983	28	13	14	12,132	25,353
1984	35	13	23	14,424	28,283
1985	37	13	41	33,274	47,195
1986	41	13	44	36,634	51,300
1987	51	13	44	36,634	52,750
1988	47	13	51	45,318	61,700
1989[1]	45	13	65	67,106	82,542

Note: [1] those five 2716-TEU vessels are not included.

Source: Containerization No.1 1990. Shanghai Maritime College. Shanghai, China.

Table 8 The COSCO's Container Liner Services (1989)

Subsidiaries & Ports	Liner Services	Schedule (per month)
COSCO Shanghai		
Shanghai To:	USA & Canada	11 - 16
	USA & Canada	28 - 3
	Australia	8 - 12
	Australia	24 - 28
	Europe	15 - 21
	Persian Gulf	26 - 30
	Japan	Every Sat.
	Japan	4 - 6
	Japan	16 - 18
	Japan	26 - 28
	S. E. Asia	28 - 2
	Hong Kong	15 - 19
	Hong Kong	30 - 5
	Hong Kong	28 - 3
	Hong Kong	--
	New Zealand	--
Lianyungang To:	Japan	Every 28th
Zhangjiagang To:	Hong Kong	3 - 5
	Hong Kong	17 - 21
	Japan	--
Nantong To:	Japan	--
	Hong Kong	--
Xiamen To:	Hong Kong	Weekly
Ningbo To:	Japan	Every 15th & 29th
COSCO Tianjin		
Tianjin To:	USA & Canada	3 - 8
	USA & Canada	18 - 23
	Persian Gulf	20 - 24

Table 8 (Continued)

	New Zealand	--
	Hong Kong	11 - 15
	Europe	1 - 5
	Japan	3 - 7
	Japan	17 - 20
	Japan	27 - 30
	Japan	23 - 26
	S. E. Asia	29 - 1
Qinhuangdao To:	Japan	--
	Hong Kong	--
COSCO Dalian		
Dalian To:	USA	Every 11th
	Japan	13 - 17
	Japan	28 - 2
	Hong Kong	10 - 13
	Hong Kong	25 - 28
	Europe	Every 7th
COSCO Guangzhou		
Huangpu To:	Europe	10 - 14
	Europe	25 - 29
	Japan	30 - 5
		& 10 - 15
	Japan	20 - 25
	USA & Canada	--
COSCO Qingdao		
Qingdao To:	Hong Kong	10 - 15
	Hong Kong	25 - 30
	Japan	12 - 15
	Japan	26 - 30

Source: Summarized from various issues of Maritime China, 1986 through 1989. Beijing, China.

over 180,000 TEUs, with 130,000 self-owned and 50,000 on long term leased. This remarkable growth has made COSCO the ninth largest containership operator in the world (see Table 3, p.5).

The problems with the current fleet are mainly associated with modern managerial skills and inland transport capabilities. With regard to managerial skills, COSCO is still in an early stage of deployment of its national collecting and forwarding systems. COSCO has begun to establish its own nationwide depot system with an emphasis on coastal and riverain provinces. Although each COSCO subsidiary has its own computerized container control system to monitor its container fleet, individual operations have not been joined together to form a national network. On the other hand, the COSCO container fleet has very limited contacts with other carriers in the world. They do not utilize the Electric Data Interchange (EDI) network, which is regarded as vital to establishing a complete door-to-door container service.

Another principal factor that impedes the efficiency of COSCO's container service is the underdeveloped inland transport facilities, which will be described in detail in following sections. In spite of a rapid build-up of container transport capacities, COSCO's container services are mainly port-to-port in contrast to container

transportation among developed economies which is door-to-door.

Generally speaking, COSCO's current fleet capacity is basically able to meet the needs of development in foreign trade. But, the large proportions of relatively old (16 years) and small-sized vessels in the fleet will have a negative impact on COSCO's further expansion.

Port Facilities

By the time that the new China came into being in 1949, the country had only 61 deep-water berths and were all in extremely poor condition. While some dramatic improvements were made to the railways prior to the 1970s, port facilities underwent very little change -- only 30 new berths were added. This lopsided development between railways and ports can be partially explained in that there are less incentives for port development. Throughout the 1950s and 1960s China had very limited overseas trade. The principal trading partner was the Soviet Union, where most of trade activities could be fulfilled through railways. Another factor was the heavy domestic transportation need.

With the expansion of foreign relations at the beginning of the 1970s, China's merchant marine began to grow. Quite suddenly, the inadequate port facilities became obvious. From 1973 to 1978, China built 78 new berths, including a number of 50,000- and 100,000-ton oil docks and several new

ports. The results were encouraging: increasing the annual handling capacity from 8 million tons of 1949 to 100 million tons of 1978.

After the policy of opening and reform had been adopted in 1978, foreign trade increased dramatically. In the early 1980s, the volume of ocean transport had tripled in comparison to the previous decade. Once again, China realized that its port capacity was inadequate to meet the need of its booming foreign trade. In 1981, for example, foreign ships called in Chinese ports were forced to lay at anchor for an average of 10.4 days, a delay which ended up costing the country more than $100 million. In order to tackle the problem at its roots, 14 major coastal cities have set up special economic development policies to make port construction the number one priority in their plans. At the same time, the State itself has also adopted new policies of enlarging the autonomy of each port and encouraging the introduction of foreign funds. These measures have brought about the second boom in port construction and expansion. Between 1979 and 1988, China achieved 107 million tons more in handling capacity by putting 106 berths at the 10,000-ton level and 104 medium-sized berths into service. During the same period of time, large-scaled specially equipped port facilities have also begun to make their appearance. The number of deep water berths has reached 253. At present, over 200 ports are

scattered along China's long coast with an annual handling capacity of more than 500 million tons. The most important ports include those located at Dalian, Qinhuangdao, Tianjin, Qingdao, Shanghai, Nanjing, Guangzhou, and Zhanjiang.

Container ports are the essential part of the basic infrastructures in container transportation. Since most of efforts and capital were spent mainly on construction of energy export and general cargo ports, construction of container ports commenced very late, and limited resources were allocated. At the very beginning, from 1975 to 1981, containers were handled by conventional break-bulk cargo facilities. Then, attempts were made to try to convert them into specialized container facilities. The first two kinds of such conversion were completed in December 1980 at Shanghai, namely, the quasi-container berths. One year later, the first purpose-built container berth went into operation at Tianjin. Aided by the World Bank, large scale container berth construction was begun at the end of 1982. Since then, annual container throughput at Chinese ports has grown significantly from 64,000 TEUs in 1980 to more than 1.17 million TEUs in 1989 (see Table 9). At present, there are over 30 ports handling international containers. The annual national throughput reached 943,773 TEUs in 1988. Among them 18 major ports (see Table 10), such as Shanghai, Tianjin, Qingdao, Huangpu and Dalian handled 920,793 TEUs, accounting for 97.6 percent of the total throughput. By the

Table 9 The Growth of Container Throughput at China's Major Ports (1984-1989)

Port	THROUGHPUT (TEUs) 1984	1985	1986	1987	1988	1989
Shanghai	115286	201750	204000	224000	314000	353836
Tianjin	83546	147876	166692	162106	214000	250000
Qingdao	23345	33383	50220	60116	86000	100000
Huangpu	21156	46754	52061	57479	84448	108000
Dalian	24275	30101	--	54035	74945	100000
Xiamen	8300	19256	14243	14276	21000	20000
Total[1]	340866	572655	627000	691190	943773	1170279

Note: [1] the total of the nation.

Source: Summarized from various issues of China Container Transport Information and Maritime China, 1985 through 1990. Beijing, China.

Table 10 China's Top 18 Container Ports (1988)

Position	Port	Throughput (TEUs)	% of Total
1	Shanghai	314,000	34.1
2	Tianjin	214,000	23.2
3	Qingdao	86,000	9.3
4	Huangpu	84,448	9.2
5	Dalian	74,945	8.1
6	Zhangjiagang	38,800	4.2
7	Xiamen	21,000	2.3
8	Fuzhou	20,000	2.2
9	Nantong	17,000	1.8
10	Guangzhou	12,000	1.3
11	Ningbo	12,000	1.3
12	Shekou	10,000	1.1
13	Nanjing	4,500	0.5
14	Shantou	3,300	0.4
15	Yantai	2,900	0.3
16	Zhanjiang	2,600	0.3
17	Qinhuangdao	1,800	0.2
18	Lianyungang	1,500	0.2
	Total	920,793	100.0

Source: Containerization No.1 1990. Shanghai Maritime College. Shanghai. China.

end of 1989, China had built 15 specialized or purpose-built container berths within six coastal key ports and one inland river port with a total designed annual capacity of 1.2 million TEUs (see Table 11). Containers are also handled by conventional facilities in China. In 1989, containers handled by conventional facilities accounted for about 25 percent of the total throughput of that year.

Construction and expansion of container berths have not been able to satisfy the needs of economic development and the desire to increase foreign trade. Most container berths can only receive second generation containerships. The main problems are caused by the lack of a sophisticated infrastructure at the ports, a scanty number of berths with low capacity, insufficient storage spaces, low managerial skills, and above all, poor transport to and from the port areas. In fact, little attention has been paid to intermodalism development by the government.

As a further rise in international trade has been predicted for the 1990s, obviously, there is an urgent need to build more container berths. According to reports from the MoC, at least seven berths are in construction phases, and the provision of more berths are under investigation. Some facilities, such as those at Shanghai, have already approached their maximum throughput. However, some evidence indicates that all ports, regardless of their size, are planning to develop container facilities in one way or

Table 11 Location of Container Berths in China (1989)

Location	No. of Berths	Capacity (TEUs)
Shanghai	4	400,000
Tianjin	4	400,000
Dalian	2	100,000
Huangpu	2	200,000
Qingdao	1	50,000
Nanjing	1	30,000
Xiamen	1	20,000
Total	15	1,200,000

Source: Summarized from various issues of in China Container Transport Information, 1985 through 1990. Beijing, China.

another. Questions arise regarding how many container berths have to be built and can be built; where these new berths should be constructed; and where the load center if any should be located.

In summary, China's port development was started at a very low level. Through much of history, port development has been very slow due to the nature of being a developing country, and an autarky nation as well. Despite the rapid growth in throughput, progress has not been able to keep pace with the national demand. Previous development had been heavily influenced by political decisions instead of economic considerations.

Coastal Navigation

The coastal navigation lines are the main transport trunk lines between north and south in China (see Figure 6). Dalian and Shanghai are the centers along the northern coast and Guangzhou is the southern center. Principal navigation lines include the Shanghai-Qingdao-Dalian, Shanghai-Yantai-Tianjin, and Tianjin-Dalian lines in the north, and the Shanghai-Ningbo-Xiamen-Guangzhou, Guangzhou-Shantou and Guangzhou-Zhanjiang-Fangcheng lines in the south. In addition, many local navigation lines function between harbors and ports as transshipment operations.

Containers transported through coastal navigation in China are very limited, reaching only 67,998 TEUs in 1989.

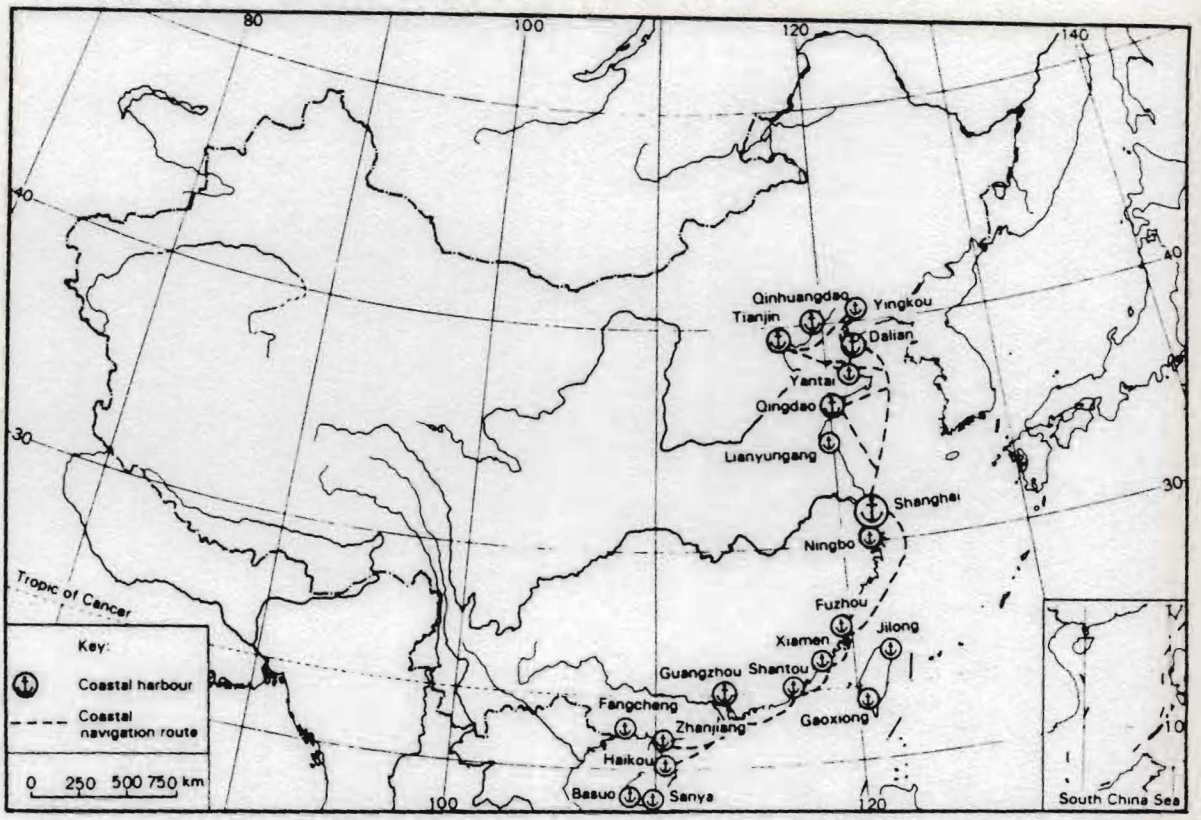

Figure 6 The Coastal Navigation Network and the Distribution of the Main Harbors in China

Source: Atlas of the People's Republic of China. Atlas Publishing House. Beijing. China. 1985

The low level of transshipment at least partially reflects the low efficiency in domestic coastal shipping.

Inland Waterways

Inland navigation was historically the most important form of transportation in China. The inland waterway system has been expanded greatly since the founding of the People's Republic (see Table 12). The system consists of some 140,000 km of navigable rivers, streams, lakes and canals. The country's longest and most important waterway is the Changjiang. Originating on the Plateau of Tibet, it traverses 6,300-km through the heart of the country before emptying itself into the East China Sea. Other major waterways, from north to south (see Figure 7), include the Heilongjiang (3,101-km), the Songhuajiang (3,101-km), the Haihe (1,090-km), the Huanghe (the Yellow River) (5,464-km), the Huaihe (1,000-km), and the Zhujiang (the Pearl River) (2,210-km).

The natural system of inland waterways in China favors the southern and eastern portions of the nation. Freight traffic is primarily served by the Changjiang and the Zhujiang systems. Indeed, most of the remaining areas are much less developed for navigation. The Changjiang is China's most important inland navigation system (see Figure 8). Together with its major tributaries, it has about 80,000 km of navigable length, representing 59 percent of the

Table 12 Comparative Lengths of Different Transport Systems in China (1949-1989)

Year	Operational Length (in km) of		
	Railways	Roadways	Waterways
1949	21,800	80,654	73,615
1950	22,200	99,600	73,615
1951	22,300	114,428	73,615
1952	22,876	126,675	95,025
1953	23,800	137,103	95,025
1954	24,500	146,138	95,025
1955	25,600	167,282	99,938
1956	26,500	226,318	103,619
1957	26,708	254,624	144,101
1958	30,200	421,800	153,000
1959	32,300	507,900	163,000
1960	33,900	510,000	170,000
1961	34,500	477,000	172,000
1962	34,600	463,500	161,900
1963	35,000	475,100	157,200
1964	35,300	479,200	156,900
1965	36,400	514,455	157,700
1966	37,800	543,600	147,200
1967	38,600	557,500	147,800
1968	38,800	571,700	147,800
1969	39,300	600,600	148,100
1970	41,000	636,700	148,400
1971	42,800	675,400	141,600
1972	43,900	699,900	140,600
1973	44,300	715,600	138,800
1974	45,100	737,900	137,400
1975	46,000	783,600	135,600
1976	46,300	823,400	137,400
1977	47,400	855,600	137,400
1978	48,618	890,236	135,952
1979	49,800	875,800	107,800
1980	49,940	888,250	108,508
1981	50,181	897,462	108,665
1982	51,541	906,963	108,634
1983	51,604	915,079	108,904
1984	51,741	926,746	109,273
1985	52,119	942,395	109,075
1986	52,487	962,769	109,404
1987	52,611	982,243	109,829
1988	52,700	990,000	124,000
1989	53,187	1010,000	140,000

Source: Summarized from Statistical Yearbook of China, 1981 through 1989. The State Statistical Bureau. Beijing, China.

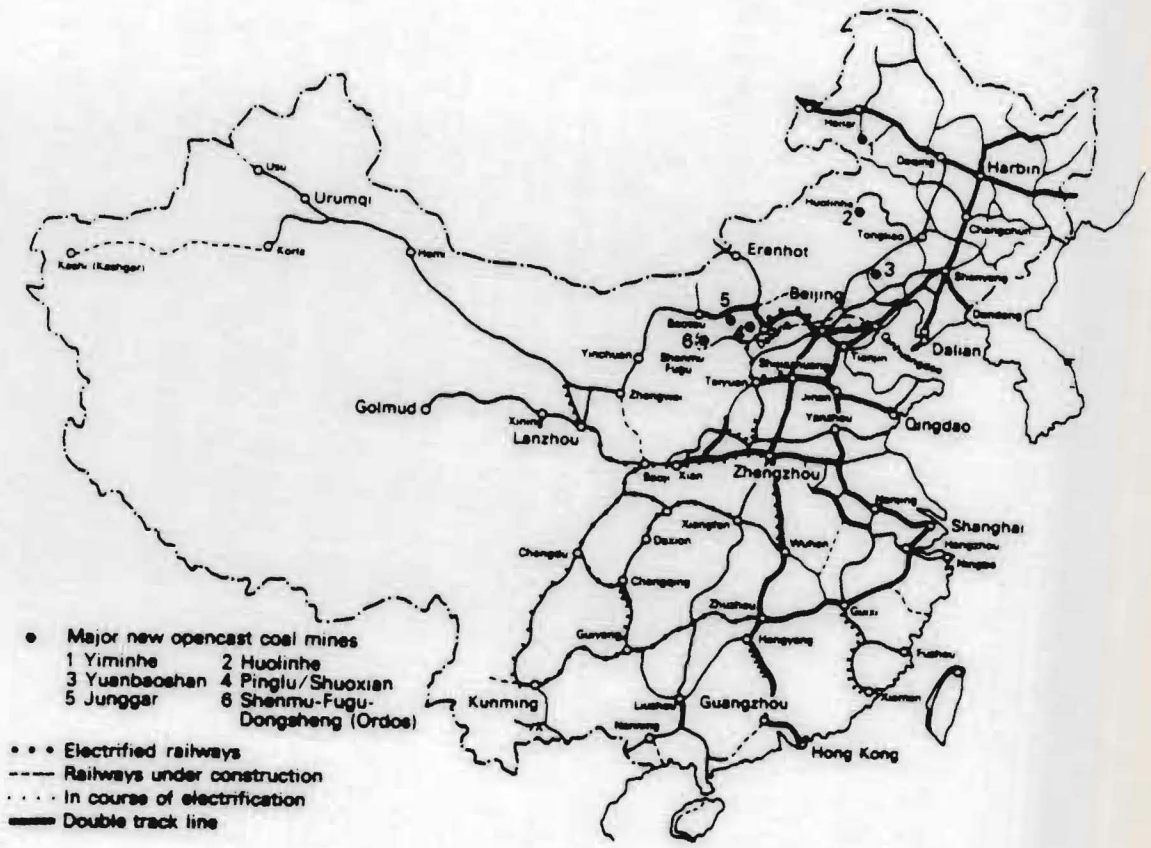

Figure 7 The Distribution of Navigable Inland Waterways in China

Source: Atlas of the People's Republic of China. Atlas Publishing House. Beijing, China. 1985

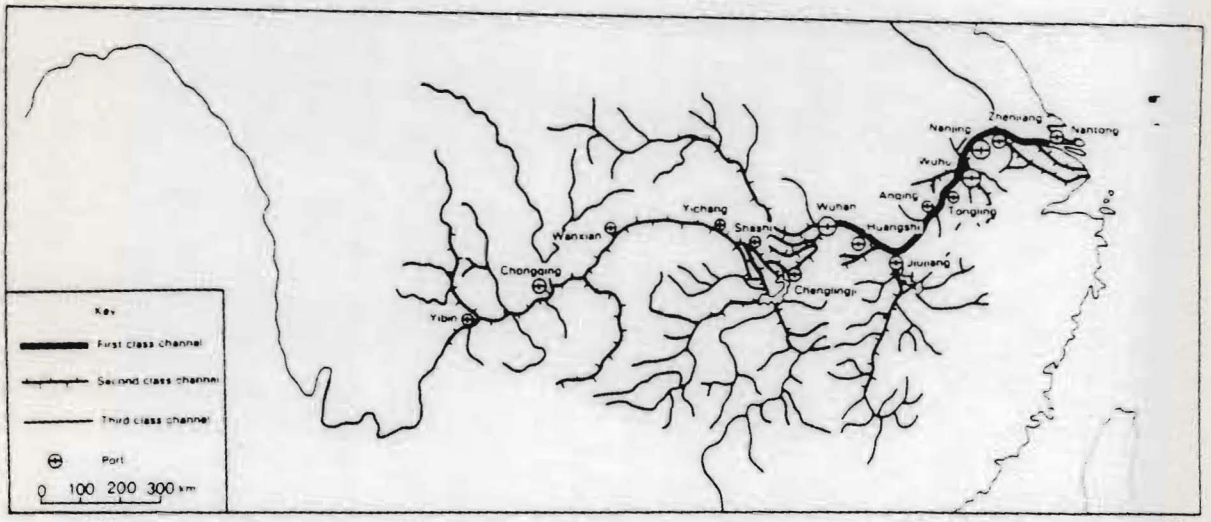

Figure 8 The Changjiang Navigation System and the Distribution of the Main Ports

Source: Atlas of the People's Republic of China. Atlas Publishing House. Beijing. China. 1985

national system. Acting as the main east-west transport artery in the country, it connects southwest and central China to east China, joining six provinces and one municipality. Along its 26,000-km main course, it serves many ports and industrial cities, such as, Shanghai, Nantong, Nanjing, Wuhu, Wuhan, Yichang, and Chongqing. In 1988, the total throughput of its 25 ports reached 140 million tons.

The growth in the volume of freight carried by the inland waterways resulted primarily from improvements in existing water routes and increases in the number, size, and speed of vessels. Channels were dredged and widened, locks were constructed, navigational aids were installed, and ports were improved, opening the system to use by larger and faster vessels for more days of the year. However, national capital investment in inland waterway has long been less than ten percent of the total transportation budget. Most rivers are still underdeveloped which resulted in serious silting, highly limiting the use of larger ships. Only recently, has China's transportation planners realized that developing, improving, and maintaining the inland waterways assures the ability to move large volumes of commodities more efficiently and economically than on railways and roadways. Having observed that billions of dollars have been spent on both the U.S. and European inland waterways, China

is currently modernizing and expanding its inland waterway system.

In container transport, China's inland waterways play a smaller role than they should mainly because they are so shallow and narrow. The Changjiang, for example, although channels were dredged and widened, the average depths of the main channel are three meters from Chongqing to Wuhan, four meters from Wuhan to Anqing, and ten meters from Nanjing to Shanghai during flood tide. As a result, a 10,000-ton vessel can only ascend to Nanjing, 5,000-ton vessel can ascend to Wuhan, and only 1,000-ton vessel can ascend to Chongqing. Therefore, most containers must be transported to Nanjing by ocean-going vessel, and then transshipped to their destinations. Short distance navigation dominates most of river sections, making the transfer of goods expensive and inefficient. In 1989, container throughput of Nanjing was 23,000 TEUs, while the capacity of the berth was 30,000 TEUs. There are quite few containers transported upstream of Nanjing in the Changjiang, only 2,000 TEUs were hauled up to Wuhan in 1988. Container transport in other inland waterways is trivial.

Railways

The railway system in China prior to 1949 was small in size, obsolete in equipment, and uneven in its distribution throughout the country. Since 1949, the existing railways

have been upgraded, new lines have been built, their transport capacity has been increased, and the distribution of rail facilities has been improved in order to meet increasing demand (see Table 12, p.51). Table 13 lists the ten main trunk lines in China's rail network. At present, most of China's railway lines are located close to the industrial and agriculture production regions. Beijing is the center of the national rail network, where railways radiate out to all parts of the country (see Figure 9).

In the northeast, the 70 lines totaling 15,000 km accounts for 30 percent of the national total. The railway density in this region averages 1.2 kilometers per square kilometer (double the national rail density). The double-tracked Harbin-Dalian line runs for 944-km south and north; the 935-km Harbin-Manzhouli line and the 548-km Harbin-Suifenhe line run east and west, connecting with rail lines of the Soviet Union at both ends playing the most important role in Sino-Soviet trade transportation. All three lines serve three provincial capitals and the harbor city of Dalian as the mainstay of the region's rail network. The double-tracked Beijing-Shenyang line (841-km) is the main line linking the northeast to the south parts of China, while the Beijing-Chengde-Jinzhou and the Beijing-Tongliao lines provide connections between the northeast and the rest of China.

Table 13 China's Ten Principal Trunk Lines in the Railway Network

(1) The Harbin-Dalian, Harbin-Manzhouli-Soviet Union, and Harbin-Suifenhe-Soviet Union trunk lines.

(2) The Beijing-Shenyang, Beijing-Chengde, and Beijing-Tongliao trunk lines.

(3) The Tianjin-Shanghai, Anhui-Jiangxi, and Yingtan-Xiamen trunk lines.

(4) The Beijing-Guangzhou line.

(5) The Jining-Erlian, Erlian-Mongolia, Datong-Puzhou, Taiyuan-Jiaozuo, Jiaozuo-Zhicheng, and Zhicheng-Liuzhou trunk lines.

(6) The Baoji-Chengdu, Chengdu-Kunming, and Yunnan-Vietnam trunk lines.

(7) The Beijing-Baotou and Baotou-Lanzhou lines.

(8) The Longhai, Lanzhou-Xinjiang, Xinjiang-Soviet Union, Lanzhou-Qinghai, and Qinghai-Golmud trunk lines.

(9) The Chendu-Chongqing, Xiangfan-Chongqing, and Xiangfan-Hankou lines.

(10) The Shanghai-Hangzhou, Zhejiang-Jiangxi, Hunan-Guizhou, and Guiyang-Kunming lines.

Source: Prepared following a brochure published by the Ministry of Railways in 1989.

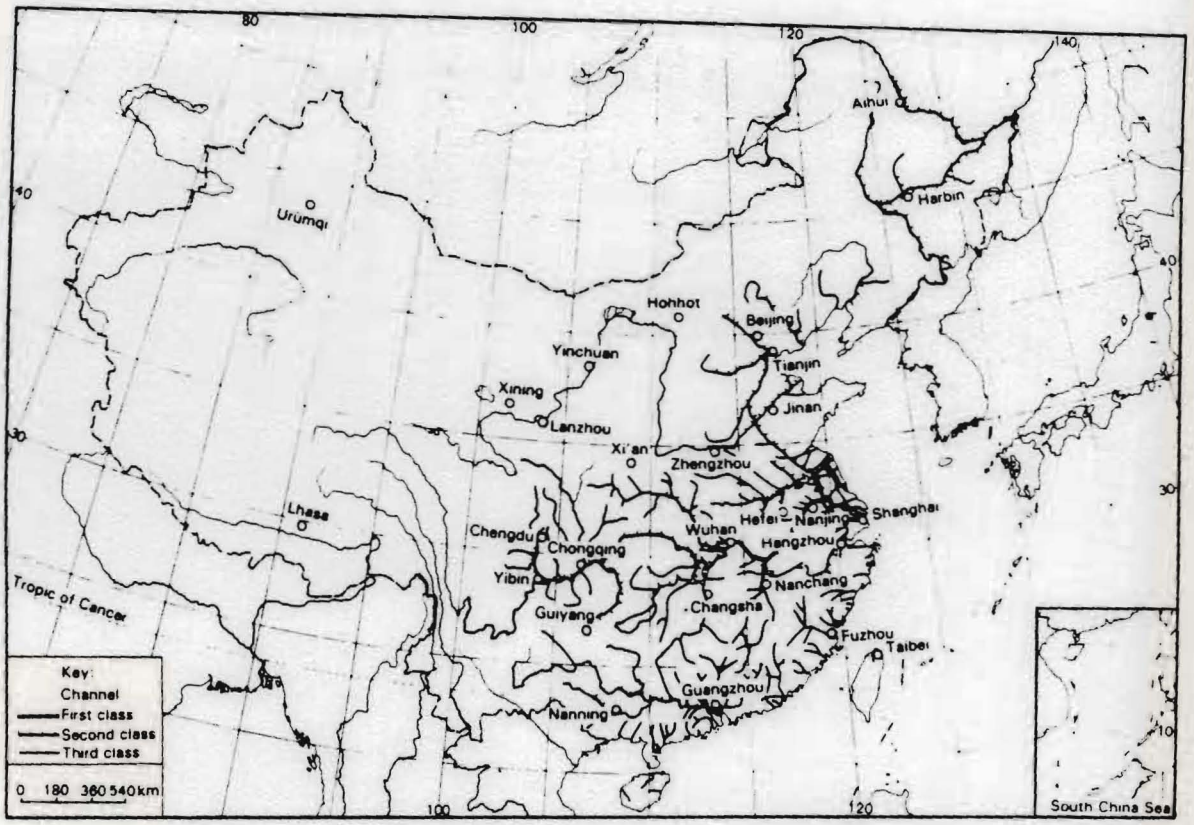

Figure 9 The Distribution of the Main Railways in China

Source: Atlas of the People's Republic of China. Atlas Publishing House. Beijing. China. 1985

The Tianjin-Shanghai, Anhui-Jiangxi, and Yingtan-Xiamen trunk lines are the mainstay of the eastern rail network. The double-tracked Tianjin-Shanghai line (1,325-km) runs through densely populated areas and is one of the busiest railways in China. The Beijing-Guangzhou line (2,324-km in length and double-tracked) is the north-south artery of China. It runs from Beijing through five provinces to China's south-most city Guangzhou. At its southern end, it joins the 1085-km Hunan-Guangxi line which connects with the rail lines of Vietnam, and is the main trunk line linking the central-south with the southwest China. The Jining-Erlian, Datong-Puzhou, Taiyuan-Jiaozuo, Jiaozuo-Zhicheng, and Zhicheng-Luizhou trunk lines form the second important north-south transport artery running through central China. At its northern end, the Jining-Erlian line leads to Mongolia and the Soviet Union, which plays the second most important role in Sino-Soviet trade transportation.

The Baoji-Chengdu-Kunming-Vietnam trunk line is another important trunk line in the southwest. The line joins the Longhai (Lianyungang-Lanzhou) line in the north and the Chengdu-Chongqing on its center. It is an important transport artery since it joins the southwest area with the northwest, north, and northeast areas.

The Beijing-Baotou-Lanzhou line, extending for 1823-km, links the north and northwest, forming the second main east-west transport artery. The Longhai, Lanzhou-Xinjiang, and

Lanzhou-Qinghai-Golmud lines together comprise the longest rail trunk line in China. The Longhai railway, which extends for 1,754-km between port city of Lianyungang in the east coast and Lanzhou, the most important city in the northwest, is the first main east-west transport artery. The capacity of this artery has been increased rapidly through the upgrading of equipment and technology and the completion of electrified and double-tracked lines. The line connects with the Tianjin-Shanghai, Beijing-Guangzhou, Baoji-Chengdu, Lanzhou-Baotou-Beijing, Lanzhou-Qinghai-Golmud, and Lanzhou-Xinjiang lines at Xuzhou, Zhengzhou, Baoji, and Lanzhou, respectively. The Lanzhou-Xinjiang railway is the only line that extends to the northwest of Xinjiang. It extends for 1,904-km between Lanzhou and Urumqi, and 460-km between Urumqi and the Alataw Pass on the Sino-Soviet border.

The Chengdu-Chongqing, Chongqing-Xiangfan, and Xiangfan-Wuhan lines are the most convenient form of transportation in and out of Sichuan province except through the Changjiang waterway system. The line connects with the country's rail networks at both ends through Beijing-Guangzhou line in the east and the Baoji-Chengdu-Kunming line in the west.

Another east-west trunk line comprising the Shanghai-Hangzhou, Zhejiang-Jiangxi, Hunan-Guizhou, and Guiyang-Kunming lines links China's largest city Shanghai with six provinces. It is the main trunk line connecting east China with the central-south and southwest. At the west end, the

Zhejiang-Jiangxi line joins to the Beijing-Guangzhou and Hunan-Guizhou lines. It also intersects lines that lead to some important harbors, such as ports of Ningbo, Xiamen, Fuzhou, and Jiujiang.

In summary, of all modern systems of transportation, railways have a unique important function to play in China at least up to the middle of 1970s. This can be identified by several facts. First, the total route length of railways has been expanded at an annual rate of over 1,000-km of repaired and new lines compared to a much lower rates of expansion in roadway and inland waterway. Second, railways have not only received very substantial government allocations of investment funds, but also have been the most profitable component of the transport enterprise. Third, railways have been undoubtedly the basic system of transportation in China for it carries the bulk of freight and passenger movements. Over 60 percent of total freight transportation and about 70 percent of total passenger traffic are handled by railways. Such a unique importance might be partially explained by the small scale in international trade. With regard to domestic activities, the railway system has more advantages than roadways, coastal and inland waterway shipping systems based on China's geographic features and the much underdeveloped economy.

In spite of the considerable development in the past, China's rail network fails to keep pace with national

economic develcpment. The length of the track is still relatively small and the technology and equipment are outdated. According to reports of National Statistic Bureau, by the end of 1989, the total length of railways was 53,187 km. The double-tracked length was 12,891 km representing only 24.2 percent of the national total. The feeder lines in the coastal areas are mostly not double-tracked. Technically speaking, steam engines still dominate the main part of the country's railways. Diesel and electric locomotives account for approximately 40 percent of the nation's total. The 6,923-km electrified track accounted for only 13.0 percent of the total. As such, the transport capacity of many trunk lines is 20 to 40 percent below present volume requirements.

Other problems include conflicts in uses between freight and passenger traffics, and low levels in management skills. So, in many important aspects, China is far behind the developed countries in terms of modernization of its rail system. Diesel and electric engines, as well as double-tracked lines are desperately required if the transport capacity of the present rail network is to be increased.

The development of railway container transport in China was initiated in 1978. Up to now, the MoR owns and operates 270,000 varieties of containers. But, most of these boxes are not standardized containers. The number of one-ton-boxes total 210,000, five-ton-boxes total 41,000, and ten-ton-boxes account for 16,000. There are also 407 container

carriages in use, each of them can load five ten-ton-boxes, or six five-ton-boxes, or two TEUs, and or one FEU. Along the trunk lines, there are 251 stations handling one-ton-boxes; 199 stations handling five-ton-boxes, 152 stations handling ten-ton-boxes, 59 stations handling TEUs, and 18 stations handling FEUs. In 1989, the total number of containers that were handled by railway amounted to 530,000, totaling 9.46 million tons of cargo. However, only about ten percent of the total boxes were TEU containers. The main factor that prevents more TEUs from being used is the low quality of the railway network, including the inadequate container carriage, handling capacity, and insufficient storage space. So, railway container transport in China is still in its nascent stage. Further containerization in railways will depend highly on a modernized railway network which will take decades for China to accomplish.

Roadways

Historically, the construction of roadways lagged behind that of the inland waterway and railway transport systems in China. By 1949, there was only about 80,000 km with poor conditions in use throughout the country. Since then, both the quantity and quality of roadways have been expanded and improved substantially (see Table 12, p.51). In 1989, there were about one million km of roadways in operation. Among them, about ten percent (10,6000 km) were national class

roads; 16 percent (16,200 km) were provincial class roads; and 75 percent (750,000 km) were local class roads. Figure 10 shows China's general roadway density distribution. Obviously, densities in the eastern part are much higher than those in the western part.

Despite the rapid development, roadway transport remains a small part in China's overall transport system, especially for movements of long distance freight traffic. Major problems are mainly associated with the low quality roads and outmoded motor vehicles. At present, roadways are mainly the means of short distance transport. Even so, they are still under severe challenge from railways. For instance, about ten percent of the total transport volume of railways is less than 20 km in distance; 15 percent is between 20 and 50 km and up to another 20 percent is between 50 and 100 km. As a result, heavy short distance transportation in railway has hampered roadway development, and resulted in economic losses to the country.

International standard expressway construction was introduced to China in the late of 1970s. The first limited access expressway, the Shanghai-Jiading line, was completed in October, 1988. Up to now, there are altogether eight lines in service, totaling to 770 km. These are the Shenyang-Dalian (375-km), Beijing-Tianjin (143-km), Shanghai-Jiading (16-km), Shanghai-Songjiang (21-km), Guangzhou-Foshan, Guangzhou-Shenzhen, Guangzhou Circuit, and

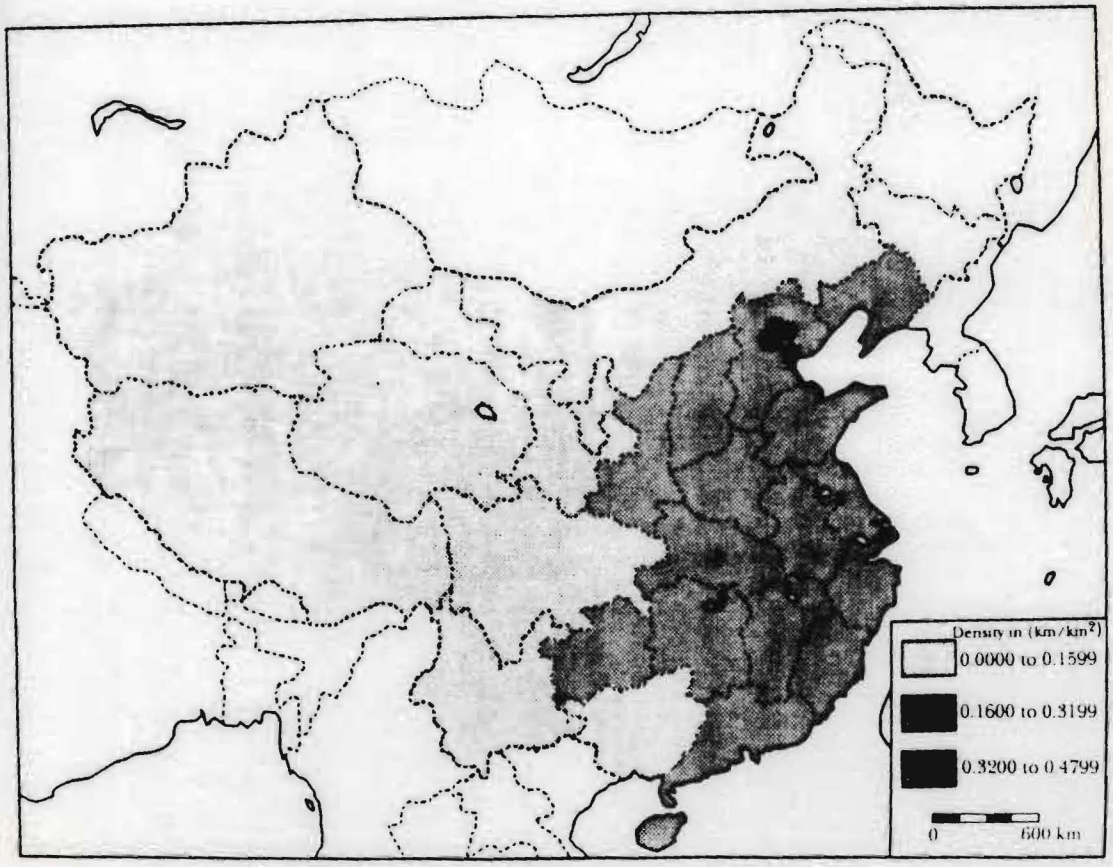

Figure 10 The Roadway Density of China

Source: Statistical Yearbook of China, 1984. Hong Kong Economic Information and Agency. Hong Kong. 1985

Xian-Lintong (24-km) expressways. Although most of them link with China's major port cities and improve inland container transport to a certain degree, its current scale is small. Most roadways are crowded with many varieties of vehicles with an average speed of less than 30 kilometers per hour. Moreover, many bridges and tunnels in the land transport system need to be reconstructed because of either low load capacities or low clearances. As a result, few containers move beyond the immediate hinterlands of the port. In 1989, there was only 250,277 containers transported on the roadways. Another factor impeding roadway container transport is that China lacks of container trucks. There are only about 2,500 vehicles that are capable to haul the standard containers. Since almost all of the vehicles are imported from foreign countries, the transportation cost of containerized cargo doubles the cost of cargo transported in conventional forms.

The Intermodal Connections

By definition, containerization consists of the simple application of temporary portable storage facilities loaded with cargo which is mobile as a unit for intermodal unified transport. It has revolutionized ocean shipping and totally changed the traditional concept of shipping. It is no longer confined to ocean shipping only, but also involves inland waterway, railway and roadway transportation in a great

depth. It is a combined transportation system with goods delivered from door-to-door instead of from port-to-port. which also changes the traditional concept of a port. With containerization, a port is no longer the terminus of ocean shipping, but serves as a gateway to an industrialized hinterland, it provides an outlet for its products and an inlet for needed raw materials.

Essentially, a comprehensive network of container service comprises a fleet to carry container overseas; port facilities to load and discharge containers to/from ships; railways, roadways or navigable rivers to collect/distribute containers from/to shippers/consignees; and advanced management skills to joint each of these modes together to achieve the effective and efficient cargo movements.
It is generally considered that shipping fleet inauguration and port construction are the first phase of development in containerization, and intermodalism reinforcement and managerial skills improvement are the second phase of development. Traditionally, the first phase development has been often much more highlighted by its high visibility, such as what happened in China. But in fact, the second phase success, which is much less visible, plays a much more important role, and is much more difficult to achieve than the first phase.

Geographically, China looks like an ideal place for intermodalism to grow. It is a large country with a long

coastline, extensive rail and road networks, and several navigable rivers perpendicular to the coast. But the real situation indicates that intermodal transportation is not good enough to deal with the current containerization development.

Even though China has an extensive rail network in many ways ideal for inland container movements, it is already very congested with other rail freight. In 1989, less than five percent of the total containers handled by ports were transported from or to ports by railways, although the longest transport distance was up to 2,227 km (averaging at 1,598 km/TEU). In addition, the average inland turnaround time was about 19 days. Inland waterway container transportation was first introduced along the Changjiang in January 1987. The total number of containers handled by inland waterways was 67,998 TEUs in 1989, representing 5.8 percent of the total number of containers handled by ports. Also, most of the movements are short distance. For instance, the total number of containers handled between Wuhan, that is the midpoint of the river, and Shanghai was only about 2,000 TEUs in 1988. Container transport between Chongqing and Shanghai along the Changjiang was initiated in the late of 1990. In roadway container transport, the total number of containers handled by trucks was relatively higher than those on railways and inland waterways. In 1989, a total of 250,277 TEUs were collected and distributed by

railways, representing 21.4 percent of the total number of containers handled by ports.

In summary, the low levels of managerial skills, rudimentary railway and roadway systems, as well as the backwardness of inland waterway transportation techniques, are the most conspicuous obstacles to the flourishing of intermodalism. As a result, very few containers were moved beyond the immediate hinterlands of the ports. Most cargoes, containerized for ocean shipping, are moved landward in break-bulk form. In 1989, more than 70 percent of containers handled by ports were stripped in ports and transported landward in break-bulk form, or assembled in ports after being transported to the ports in break-bulk form. This definitely lowered the efficiency of container transport.

CHAPTER IV

COMPARATIVE ANALYSIS AND RECOMMENDED STRATEGIES ON CHINA'S CONTAINER TRANSPORTATION SYSTEMS

Worldwide Competition in Container Services

Although COSCO is among the world's top 20 container operators, in the aspects of shipping, it has a very limited potential to compete in worldwide services. First, based on vessel size among the top 20 (see Table 14) the capacity of COSCO's largest vessel is relatively small. All COSCO vessel capacities are below 3,000 TEUs, which has become more and more prominent in around world services. A breakdown of TEU slots on order also shows a slow capacity increase for COSCO by the year of 1993 (see Table 15).

Secondly, in spite of a slowdown in average annual growth rates during the 1990s, the growing appetite of Asia's emerging economic powers will alter cargo balances on some routes, and it is intra-Asian traffic that will benefit most. Strengthening of trades with Asian countries has recently led to a shortage of containerships for both major lines and feeder operations, resulting in high number of charters (see Tables 16 and 17), higher resale values and a marked decline in scrappage. However, there is little

Table 14 1990 World's Top 20 Container Service Operators, Analyzed on the Basis of Vessel Size (TEU Capacity)

Operator	≦1000	1000-1499	1500-1999	2000-2499	2500-2999	≧2999	Total
Evergreen	15876	11912	10860	0	54560	37708	130916
Sea-Land	11065	18040	1924	12746	30120	41472	115367
Maersk	10073	3666	6900	18964	5100	50000	94703
NYK	16500	7385	15837	11349	16223	10854	78148
MOL	17700	3594	12437	6480	26510	3613	70334
APL	5980	5600	0	8000	25300	21500	66380
OOCL	5279	0	6103	11180	12705	22850	58117
K-Line	8590	1139	1830	13392	20143	10368	55462
COSCO S.H.	14414	20704	8435	0	10952	0	54505
Hapag-Lloyd	4628	6019	4849	9020	22176	6486	53178
Hanjin	760	6944	9883	0	32034	0	49621
P&O	2217	5075	14638	0	20212	7226	49368
Yangming	757	0	21340	0	0	24720	46817
Zim	14178	7045	12097	11596	0	0	44916
Nedlloyd	13871	10516	13186	0	2762	0	40335
BSC	23148	10522	3090	0	0	0	36760
NOL	2936	1281	6682	8482	5932	9981	35294
ScanDutch	2670	1452	4866	6705	17255	0	32948
SNCDV	14617	8610	7977	0	0	0	31204
CGM	1608	14243	10664	2525	0	0	29040
Total	186867	143747	173598	120439	301984	246778	1173413
World T.	1309336	510391	375127	200112	375340	255874	3026180
20's share	14.3%	28.2%	46.3%	60.2%	80.5%	96.4%	38.8%

Source: Containerization International 24(6): 48, June 1990.

Table 15 1990 World's Top 20 Container Service Operators, a Breakdown of TEU Slots on Order, and Projected 1993 Tally

Operator	Current	Contracted	Projected	Percentage of Existing Fleet
Evergreen	130916	0	130916	0.0
Sea-Land	115367	0	115367	0.0
Maersk	94703	38000	132703	40.1
NYK	78148	14418	92556	18.4
MOL	70334	7226	77560	10.3
APL	66380	0	66380	0.0
OOCL	58117	0	58117	0.0
K-Line	55462	1700	57162	3.1
COSCO Shanghai	54505	5460	59965	10.0
Hapag-Lloyd	53178	24537	77715	46.1
Hanjin	49621	16468	66089	33.2
P&O Containers	49368	2400	51768	4.9
Yangming	46817	10500	57317	22.4
Zim	44916	16814	61730	37.4
Nedlloyd	40335	23400	63735	58.0
BSC	36760	15124	51884	41.1
NOL	35294	1526	36820	4.3
ScanDutch	32948	11625	44573	35.3
SNCDV	31204	6600	37804	21.2
CGM	29040	5388	34428	18.6
Total	1173413	201186	1374599	17.1
World Total	3026180	367033	3393213	12.1

Source: Containerization International 24(6): 49, June 1990.

Table 16 1990 World's Top 20 Container Service Operators. a Breakdown between Owned and Chartered in TEU Slots

Operator	Total Operated	Total Owned	Total Chartered in	Percentage of Chartered in
Evergreen	130916	129064	1852	1.4
Sea-Land	115367	72738	42629	37.0
Maersk	94703	53036	41667	44.0
NYK	78148	27693	50455	64.6
MOL	70334	22997	47337	67.3
APL	66380	39140	27240	41.0
OOCL	58117	55888	2229	3.8
K-Line	55462	26332	29130	52.5
COSCO Shanghai	54505	54505	0	0.0
Hapag-Lloyd	53178	40812	12366	23.3
Hanjin	49621	47822	1799	3.8
P&O Containers	49368	36994	12374	25.1
Yangming	46817	46817	0	0.0
Zim	44916	23711	21205	47.2
Nedlloyd	40335	30346	9989	24.8
BSC	36760	36760	0	0.0
NOL	35294	33270	2024	5.7
ScanDutch	32948	0	32948	100.0
SNCDV	31204	17173	14031	45.0
CGM	29040	20565	8475	29.2
Total	1173413	815663	357750	30.5

Source: Containerization International 24(6): 49. June 1990.

Table 17 1990 World's Top 20 Container Service Operators, a Breakdown between Owned and Chartered out TEU Slots

Operator	Total Operated	Total Chartered out	Percentage of Chartered out
Evergreen	129064	0	0.0
Sea-Land	72738	0	0.0
OOCL	67182	11294	17.4
COSCO Shanghai	56014	1509	2.7
Maersk	53036	0	0.0
Nedlloyd	49672	19326	38.9
Hanjin	47822	0	0.0
Yangming	46817	0	0.0
Hapag-Lloyd	45423	4611	10.2
P&O Containers	44092	7098	16.1
APL	42476	3336	7.9
BSC	36670	0	0.0
NOL	35294	0	0.0
K-Line	31622	5290	16.7
USAC	31015	5429	17.5
Fesco	28967	2089	7.2
CGM	28856	8291	28.7
NYK	27693	0	0.0
MSC	26415	0	0.0
DSR	26047	1562	6.0
Total	927005	69835	7.5

Source: Containerization International 24(6): 51, June 1990.

indication that COSCO has participated in such activities to a great depth.

Thirdly, the high demand for new tonnage has had the effect of pushing containership prices up to a level which can not easily be supported by current freight rates. According to report from the Journal of Japanese Shipbuilding, for instance, a 2500-TEU containership cost about $42 million in May 1989, representing a 36 percent increase compared to the previous year's cost. As presented in Table 18, there are 110 ships, totalling 367,033 TEUs of slot capacity currently on order. It is the highest level since 1983, and represents around ten percent of the total TEU capacity of all vessels in service at the end of 1989. Among the newbuildings, the trend is moving towards larger ships. There are 32 vessels, and about 75 percent of the contracted capacity is for ships loading 3,000 TEUs or more. On the other hand, there is a marked trend towards bigger feeder ships. Even among the top 20 container operators of contracted newbuildings, nine feeder ships have been ordered, reaching a total capacity of 2,834 TEUs. It has been noted, that as number nine in the world's top 20 operators, COSCO Shanghai has only ordered two vessels with 2700-TEU each, staying at the last position in the world's top 20 operators of contracted newbuildings tonnage capacity. Therefore, in terms of total TEU capacity, as well as the size and age distributions of COSCO's fleet

Table 18 1990 World's Top 20 Container Operators of Contracted Newbuildings Tonnage (in TEU Capacity)

	Total Capacity	No. of Ships	Capacity
Maersk Line	38,000	7	4,000
		10	1,000
Hapag-Lloyd	24,537	5	4,400
		1	2,537
Nedlloyd Lines	23,400	5	3,100
		2	3,950
Zim	16,814	7	2,402
Hanjin Shipping	16,468	6	2,678
		1	400
Baltic Shipping Co	15,124	5	2,668
		5	302
		1	274
NYK	14,418	1	3,618
		3	2,800
		2	1,200
Senator Line	13,400	4	2,000
		3	1,800
Fesco	13,340	5	2,668
ScanDutch	11,625	1	4,425
		2	3,600
Yangming	10,500	3	3,500
Lloyd Triestino SpA	9,000	3	3,000
MISC	8,102	1	4,400
		3	1,234
MOL	7,226	2	3,613
SNCDV	6,600	3	2,200
Contship	6,400	4	1,600
APL	6,040	2	2,700
		1	400
		1	250
Dole Fresh Fruit	5,994	3	1,278
		2	1,080
Hamburg-Sud	5,960	2	1,960
		2	1,020
COSCO Shanghai	5,460	1	2,760
		1	2,700
Total	258,408	110	
World Total	367,033		
Top 20 Share	70.4%		

Source: Containerization International 24(6): 51, June 1990.

(see Tables 19 and 20), China is less possible to cast a big shadow on the world container shipping service in the near future.

Another significant presence in the worldwide container shipping competition is the secondhand vessel problem. As mentioned above, container liner operators around the world are preparing to acquire new ships. As a result, there will be more and more secondhand containerships hitting the market. It has been predicted that there will be a secondhand market in the early to mid-1990s dominated by vessels built in the early to mid-1970s, which are mostly around the 2000-TEU bracket. Obviously, apart from the option of scrapping, shipping companies from some poorer or emerging countries, such as China, the Soviet Union and other southeast Asian countries, are going to become feared competitors.

In the aspect of port container traffic, Chinese ports are far away from the world leaders. Comparing with those large ports around China (see Table 4, p.6), Shanghai, the largest port in China, handled only about 7.9 percent of the throughput of Hong Kong, 8.1 percent of Singapore, 10.5 percent of Kaohsiung, 14.4 percent of Kobe, 16.4 percent of Busan, 19.8 percent of Keelung, 23.5 percent of Yokohama, and 24.6 percent of Tokyo in 1989. In terms of container traffic by country and region, China is also ranked on the lower end of the world's top 20 countries and regions. While

Table 19 The COSCO's Containerships. a Breakdown by Size (1985-1990)[1]

Size Class (dwt)	1985 No. of Ships	1985 1,000 dwt	1986 No. of Ships	1986 1,000 dwt	1987 No. of Ships	1987 1,000 dwt
5000-7499	--	--	6	37.3	8	49.6
7500-9999	--	--	8	70.3	8	70.3
10000-12499	--	--	1	12.3	0	0.0
12500-14999	--	--	2	25.0	5	63.5
15000-19999	--	--	1	17.0	1	17.0
20000-29999	--	--	11	269.3	11	269.3
30000-39999	--	--	3	97.5	5	162.8
Total	13	196.2	32	528.7	38	632.5

Size Class (dwt)	1988 No. of Ships	1988 1,000 dwt	1989 No. of Ships	1989 1,000 dwt	1990 No. of Ships	1990 1,000 dwt
5000-7499	9	57.1	9	57.1	10	63.2
7500-9999	10	83.1	10	87.3	10	87.2
10000-12499	0	0.0	0	0.0	2	22.3
12500-14999	5	63.5	6	72.6	6	76.2
15000-19999	1	17.0	1	17.0	1	17.0
20000-29999	16	395.4	16	395.2	20	482.2
30000-39999	5	161.8	6	194.8	5	161.8
40000-49999	0	0.0	0	0.0	2	93.2
Total	46	782.1	48	827.7	56	1003.1

Note: [1] as of January 1st of each year.

Source: Summarized from Shipping Statistics Yearbook, 1985 through 1990. Institute of Shipping Economics and Logistics. Bremen, Germany.

Table 20 The COSCO's Containerships, a Breakdown by Age (1985-1990)[1]

Division of age	1985	1986	1987	1988	1989	1990
0 - 4	--	24	27	23	3	3
5 - 9	--	3	4	8	29	31
10 - 14	--	4	6	9	6	7
15 - 19	--	1	1	2	5	7
20 - 24	0	0	0	4	5	8
25 & above	0	0	0	0	0	0
Total	13	32	38	46	48	56

Note: [1] as of January 1st of each year.

Source: Summarized from Shipping Statistics Yearbook, 1986 through 1990. Institute of Shipping Economics and Logistics. Bremen, Germany.

expansions are either underway or projected in all those ports around China mentioned above, China's container ports will be much less competitive in the region in the foreseeable future.

Future Economic and Foreign Trade Prospects of China

Historically, foreign trade has not accounted for a large sector in China's economy. Although it was still small relative to domestic production, the amount of commerce with foreign countries and regions has increased almost year by year over the past 40 years (see Table 21). Also, the importance of China's foreign trade has far exceeded its volume. Indeed, foreign imports have alleviated critical shortages of agriculture products, raw materials, and manufactured goods. Foreign trade has also played a key role in the aquisition of advanced equipment and technology, which speeds up China's own technological innovation and economic growth. The general pattern of China's trade activities is that advanced industrial products and technology are imported from developed countries and regions and are paid for by exportation of crude materials and consumer goods. In the 1950s, shortly after the People's Republic of China was founded, its main trade partners were the Soviet Union and Eastern European countries, and both import and export goods were mainly transported by railways. After the 1960s, China started foreign trade with the

Table 21 China's Foreign Trade[1] (1950-1989)

Year	Total	Exports	Imports
1950	1,135	552	583
1951	1,955	757	1,198
1952	1,941	823	1,118
1953	2,368	1,022	1,346
1954	2,433	1,146	1,287
1955	3,145	1,412	1,733
1956	3,208	1,645	1,563
1957	3,103	1,597	1,506
1958	3,871	1,981	1,890
1959	4,381	2,261	2,120
1960	3,809	1,856	1,953
1961	2,936	1,491	1,445
1962	2,663	1,490	1,173
1963	2,915	1,649	1,266
1964	3,463	1,916	1,547
1965	4,245	2,228	2,017
1966	4,614	2,366	2,248
1967	4,155	2,135	2,020
1968	4,048	2,103	1,945
1969	4,029	2,204	1,825
1970	4,586	2,260	2,326
1971	4,841	2,636	2,205
1972	6,301	3,443	2,858
1973	10,976	5,819	5,157
1974	14,568	6,949	7,619
1975	14,750	7,264	7,486
1976	13,433	6,855	6,578
1977	14,804	7,590	7,214
1978	20,638	9,745	10,893
1979	29,333	13,658	15,675
1980	37,822	18,272	19,550
1981	40,375	20,893	19,482
1982	39,297	21,819	17,478
1983	40,727	22,197	18,530
1984	49,772	24,416	25,356
1985	60,246	25,915	34,331
1986	60,097	27,014	33,083
1987	68,110	34,711	33,399
1988	79,419	40,102	39,317
1989	81,490	43,220	38,270

Note: [1] in million U.S. dollars.

Source: Summarized and Calculated from Statistical Yearbook of China, 1985 through 1989. The State Statistical Bureau. Beijing, China.

western countries, and ocean shipping became the principal means of transport of imports and exports. At present, its primary foreign trading partners are Japan, Hong Kong, the U.S., and the European countries.

Transportation development is closely associated with other economic sectors and provides service to them. The development of China's containerization since the late 1970s has been determined by a combination of domestic and international factors. Domestically, the launching of the Four Modernizations and the rapid development of the national economy must be credited first. Internationally, the adoption of an open-door policy, the improvement of China's foreign relations with western countries, and the rapid growth of foreign trade since 1978 (see Table 21, p.81) have significantly promoted the expansion China's shipping fleet and port facilities. In 1980, China's total freight volume was only 8,809 million tons, but it hit a record high of 18,675 million tons in 1988.

It was about ten years ago that the central government in Beijing initiated an ambitious economic reform. Indeed, according to both official statistics and foreign observers, China has achieved remarkable growth during the last decade. However, it is difficult to foresee China's future economic growth and trade when faced with politically generated uncertainties. In the light of the event of mid-1989, even up to now, China's political and economic configuration

still remains as an uncertainty. It also does not seem likely that a stable structure can be restored in the near future. But, it is very clear that a continual ambiguous political future will definitely result in a low domestic economic growth rates and a reduction of foreign trade activities. Historical experience has already proved that national economic prosperity can not be achieved without enhancing foreign trade, and isolation is by no means positive toward promoting a country's economic development. A commitment to the policy of opening up to the outside world is not only in conformity with the international trends of the times, but also contributes a great deal to a country's economic development. Therefore, China's future progress in containerization, as well as all other economic sectors, will strongly depend on its political environment.

A Further Decentralized Management System

China's future success with containerization is highly dependent on further decentralization of its management system. Since it is a socialist country, basically there are two different economic models that can be applied. They are the traditional centrally planned economy model, and the decentralized planned market economy model.

In the traditional system, the power of decision-making over national macro-economic and micro-economic enterprises' performances is vested in the central government. The main

function of the State is to set up a national economic plan, to control and distribute resources and revenues, and to issue detailed targets for individual enterprises which operate within the limits of the State's rules and regulations. This entails direct and comprehensive State control on economic performances through planning, and creates a huge bureaucratic organization whose main task is to reinforce State's directives and supervise the enterprises' economic activities. As a result, enterprises are operated by administrative orders rather than market mechanisms. Market mechanisms play no role in planning, and an insignificant role in management. Economic information is solely transmitted vertically through the designated channels, which is very inefficient for lateral communication and cooperation.

The significant merit of this economic model is that the State can concentrate labor forces, and financial and natural resources on key projects. But as the economic system has entered into a much more sophisticated stage, the shortcomings of this model tend to undermine some of its merits. To some extent, this economic model succeeds only in military related industries, such as the detonation of an atom-bomb. It is at a disadvantage by confining the scope of initiatives and leaving no incentives for either enterprises or individuals to provide timely solutions to contradictions between supply and demand, to achieve better economic

results. Economic growth resulting from the traditional centrally planned economy model fluctuates. The typical consequences in applying this model are a large military buildups and some huge appealing inaugurations on one hand, and a low levels of people's living standards on the other hand. These were the most important stimuli for Chinese leaders to adopt an open door policy in the late 1970s.

The decentralized planned market economy model is virtually a planned economy where market mechanisms are integrated. It is different from the traditional one in that the power of decision-making over micro-economic performances is basically delegated to enterprises, targets set for products under the State plan are reduced, and the value of product is given much greater emphasis. With regards to planning, in the decentralized planned market economy the State still holds the power to decide national strategic macro-economic plans, whereas market mechanisms are allowed to play complementary roles. In the aspect of management, this model attempts to integrate administrative controls and economic measures in such a way that economic management is achieved by economic measures supplemented by administrative controls. The most significant advantage of the decentralized model is that it enables enterprises and individuals to have a greater incentive and enthusiasm to provide timely solutions in achieving better economic results. Also, lateral contacts, information transmissions

and potential cooperation between enterprises and between suppliers and consumers are interwoven with the vertical channels between the State and enterprises.

By examining China's previous achievements in container transportation, it is positive to conclude that it has greatly benefited from the traditional planned economy. As pointed out before, containerization is a high-capital and material concentrated undertaking. China's speedy inauguration of both container shipping fleet and container berths would be much less significant without the State's ability to concentrate large financial and material resources on container transport. However, as the second phase development focuses on intermodal efficiency improvement, the traditional centralized system is inherently inadequate. In the traditional system, economic information are mainly transmitted within each individual ministry. It provides, inevitably, a low efficiency in lateral communications and cooperation which are vitally needed to promote intermodalism. In contrast, the decentralized planned market system promotes lateral communication and potential cooperation among related ministries and enterprises. It also provides more freedom to form mutually beneficial regional programs. Therefore, China's future success in containerization will be highly dependent on a further efforts in decentralization.

The decentralized planned market economic system is definitely not only applicable to China's containerization development, but also applicable to all market related fields. Unfortunately, the decision of whether or not to adopt this system is still being debated by China's top political leaders. The major concern from the opposition side is that the application of this economic model may lead enterprises away from the State control, which would have a negative impact on the planned economy.

Ranking of Priorities

Besides the political ambiguity, the availability of national economic resources will play an important role in China's future containerization development. Resources are scarce because they have many alternative uses. The desire to invest in any mode of transportation must be balanced against the fact that something else must be sacrificed. Such concern is particularly important in China due to the nature of the centrally planned economy and its access to very limited foreign exchange. Therefore, balancing judgments are vital in future development plans.

In order to determine priority rankings, it is necessary to understand the advantages and disadvantages to developing containerization in China. Generally speaking, container transport is affected by four factors: geographical location; market demand; intermodal connections; and service

quality. Geographically, China can be considered as an ideal place to develop container transport. A large country with a long coastline, a massive population, an extensive railway system and navigable rivers can all be recognized as advantages. However, on the other hand, China is geographically disadvantaged within the Far East region. All Chinese ports are surrounded by the world's top container ports and impacted by the world's busiest shipping lines. There are the ports of Busan, Kobe, Yokohama, and Tokyo in the northeast and east, the ports of Keelung and Kaohsiung in the southeast, and the ports of Hong Kong and Singapore in the south. As indicated in Chapter 4, none of the Chinese ports are comparable to those cited above in terms of container throughput. Therefore, it is not necessary for China to build any load centers in the near future. The only way to minimize the disadvantage of being surrounded by several load centers is to utilize them to a greater degree. Concentrating more efforts and resources on feeder services within the region, and limiting efforts and resources on major line competition would be a wise strategy for China.

With regards to container transport demand, China has a great potential market. According to government report, as little as 25 percent of general cargo has been currently containerized. Besides exporting large volumes of raw material, there remains considerable potential to switch break-bulk traffic to containers in China. More importantly,

high demands will be further increased by a possible economic boom.

Concerning intermodal connections, China's development in containerization currently does not provide any advantages. Due to a poor inland transport systems, it seems that, unfortunately, the more containers received from ports the lower its efficiency will be. Speeding up construction of container ports will not help to increase the efficiency of the entire system. Therefore, in order to increase total throughput, constant efforts and capital must be spent on upgrading land transport facilities, on improving land and ocean links, and on removing bottlenecks.

Among all the different systems of inland transportation, each system has its own advantages. In general, railways have the advantages of having a large transport capability; occupying little land; being faster than water transportation; being more energy efficient than roadway; and being relatively cheap to operate. Inland waterways have the advantages of having large transport capacity; and cheaper operational cost than railways and roadways. While roadways have the advantages of having more flexible routeways than railroads and inland waterways; relatively easier to construct with shorter construction periods than railways and inland waterways. In view of the huge size of the country and the current situation of inland transportation systems, railways are the key to expanding

long distance container movements while roadways are the key for short distance movements.

In the aspect of service quality, the development of containerization is also disadvantaged. Low managerial skills are a major concern. Considerable gains could be made in the entire transport system through a better management system. There is an urgent need to establish the EDI network, management experience and qualified management staff members are also desperately needed. Therefore, more attention ought to be placed on training management specialists by using different educational methods, and on enhancing exchange with foreign companies.

In summary, the overall priority in developing containerization should be to improve the landwards transportation systems. For long distance transport, it is railways that efforts and resources should concentrated on. While for short distance transport, it is roadways. For shipping and port facilities, feeder services within the Far East region should receive a higher priority. Also, a constant efforts should be made to increase managerial skills.

CHAPTER V

CONCLUSIONS

Based on the previous analyses, the final conclusion of this paper is that the application of container technology in China will be definitely extended. Progress in containerization, however, will not be significant in the near future. It will take decades before China can catch up with the advanced world level of container transportation. As indicated above, the structure of China's transportation system is closely related to its social system, geographical conditions, economic structure, economic and technical levels, consumption levels, and international environment. As it has taken a long time for the present transport structure to be developed, a long time and a large amount of investment to readjust it to container transport will inevitably be required.

Also, China's future development in containerization can not be predicted solely by its first phase achievement, which mainly concentrated on shipping fleet inauguration and port construction. First of all, future containerization development will depend on the political stability. Historically, China's national economy has been heavily

influenced by its political instability, and its transportation development has been influenced by political decisions.

Secondly, future success with containerization requires a favorable political atmosphere which includes a more decentralized central government system. Only under such a system, would different transport projects be possibly financed, constructed and administered at their appropriate levels, and would enterprises and individuals have more incentive to contribute to the economic development of all containerization related activities.

Finally, China's future success with containerization is highly dependent on the improvement of its inland transportation systems, which are so weak that they do not match current shipping and port facilities. Container transportation is a system which is composed of inseparable sub-systems and components. The efficiency of the whole system could be significantly impaired by a break down of any of the linkages in the system. An ideal system makes full use of the available natural resources and all the advantages of each transport systems to provide fast and well organized services for container movements.

The recommended strategies for China's future success in containerization then can be summarized as follows:

(1) An overall effort should be placed on releasing landwards pressures on exporting and importing containerized cargoes.

(2) In shipping services, efforts should not be focused on building large vessels nor on keeping its high tonnage position among the world's carriers. Efforts and financial resources should be concentrated on reinforcing regional feeder services and advancing management efficiencies. More feeder services should be provided between China and Japan, South Korea, Singapore, Hong Kong, and Taiwan, and more capable vessels should be deployed in those services. All container transport managerial computer networks should be integrated and connected with existing global systems. More attention should be placed on staff training and education.

(3) Construction of container berths should be in proportion to the development of inland transportation systems. The number of container berths should be those that are able to meet the needs of the country's foreign trade activities. As the price for building new container berths is very high, China should make full use of its present container berths, and at least temporarily encourage handling more containers at conventional facilities.

(4) Natural conditions have indicated that China can not depend on its inland waterways to transport containers, at least not in the near future. No additional container berths are immediately necessary along the nation's inland waterways. Containers transported by inland waterways should be mainly handled at conventional facilities. Long-term efforts and financial investments should be centered on channel dredging and maintenance.

(5) Roadway transportation should be developed moderately due to its current poor shape and the fact that China lacks of capital and capability of producing heavy vehicles. At least in the near future, it is not necessary for the country to build any long-distance expressways. Attempts in roadway container transportation should be limited in developing local expressways around major ports to enhance their radiating abilities.

(6) Railway construction should be focused on improving existing lines, such as double-tracking and electrifying main trunk lines, rather than building new lines. From the economic point of view, and considering the existing roadway and railway systems, long-distance transportation by rail should be given more incentive and investment. As an economic measure, short-distance transportation rates by rail

should be raised to encourage roadways to play a larger role in short-distance transportation.

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